Lucent Technologies
Bell Labs Innovations

AnyMedia® Access System

(24 Channel)
Optical Network Unit
Installation Manual for Outdoor Applications

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About This Manual

Introduction

Purpose

This Installation Manual (IM) provides installation instructions for Lucent Technologies' *AnyMedia* Optical Network Unit (ONU) for outdoor applications. The system is available in three configurations:

- Wall-mounted,
- Pole-mounted,
- Pedestal-mounted.

Another model of the ONU is available for indoor applications, but is not discussed in this manual. If you are interested in obtaining more information on the ONU for indoor applications, contact your Lucent Technologies representative.

Scope

The ONU IM is intended to enable installation personnel to install the *AnyMedia* ONU. In principal, the ONU will be delivered with all passive system components and with all internal cabling pre-installed, including the cabling from the APs of the ONU shelf to the feeder side of the internal MDF. The installer has mainly to perform the connections from and to the ONU (AC, fiber, and distribution side of the MDF). Installation of the application packs and turn-up are performed after the installation procedures described in this manual are complete.

Intended audience

This installation manual is for technical support personnel and for customers who maintain their own installation organizations.

Reason for issue

This is Issue 1 of the Installation Manual.

How to use this manual

This manual is organized as follows:

- How are we doing

  A comment form so readers can give feedback to improve the next revision of the document.

- *Table of contents, list of figures, list of tables*.

- About This Manual

  This chapter defines the purpose of the document and the intended audience. Also included are topics about the conventions used in the document, related documentation, how to order documents, and how to comment on this document.

- Safety

  This chapter defines the types of safety labels and precautions associated with the *AnyMedia* Access System. Also included are general circuit pack handling precautions and specific warnings relating to lightwave safety, ESD considerations, handling batteries, connecting to AC utility, and other built-in equipment.

- ONU Product Description

  This chapter describes principal components that comprise the outdoor *AnyMedia* ONU.

- Overview of the Installation Process

  This chapter summarizes the ONU installation and cabling process and lists the tools and test instruments you will need to accomplish the installation.

- Site Ground for Pedestal Mounted ONUs

  This chapter addresses the site grounding requirements and recommended connections for a pedestal-mounted ONU. This chapter does not apply to pole-mounted or wall-mounted ONUs.

- Mounting the ONU

  This chapter describes the procedures for mounting the cross-connects in the ONU termination compartment; for mounting/installing the ONU; and for connecting it to the site ground. These mounting procedures must be performed before you connect any external cables to the ONU or power-up the system.

- Installing and Grounding External Cables

  This section describes the procedures for installing and grounding the signal and power cables required by the ONU.

- Connecting the Signal Lines

  This chapter provides the procedures for installing the ONU copper and fiber signal cables.

- Connecting AC Power

  This chapter describes the requirements and procedures for connecting the ONU to the local electric utility.

- Installing the Batteries

  This section provides the procedures for unpacking, inspecting, and mounting the batteries in the ONU battery compartment.

- System Power Up

  This chapter provides the procedures for installing power-related modules, applying AC power and activating the batteries.

- Fan Unit and Battery Maintenance

  This chapter covers the recommended maintenance procedures for the *AnyMedia* ONU fan units and batteries.

- *Appendix A: Installation and Maintenance Record*

  This appendix contains a copy of the installation and maintenance record.

- List of Acronyms

  Lists the abbreviations and acronyms used to replace longer expressions.

- Glossary

  Defines terms that may be unfamiliar to the user.

- *Index*

  Lists in alphabetical order the specific subject information in the document.

Conventions Used in This Document

Terms used

The following terms used in this manual may have different meanings than the general or common usages of the term.

- The term *AnyMedia* Access System is used here for both the *AnyMedia FAST* shelf and for the *AnyMedia* ONU subshelf.
- The term *system configuration* when used here refers to an *AnyMedia* Access System system equipped with certain packs or units for a certain application.
- *Mixed configuration* means a configuration of the *AnyMedia* Access System that includes packs for narrowband and AFM xDSL services.
- The term *AnyMedia FAST* shelf is used when the text refers to the shelf which houses the COMDAC, CTU, OAP, and AFM pack.
- The term ONU shelf is used when the text refers to the shelf in the ONU (housing the OCP) that provides the interface for the optical link to the *AnyMedia FAST* shelf.
- The term *AnyMedia* shelves is used whenever the text does not need to distinguish between both types of shelves.
- Narrowband services typically include POTS services, coin, special services such as foreign exchange and PBX support. In the current release of the *AnyMedia* Access System, narrowband services comprise POTS, COIN, PBX support, ISDN services, and high bit-rate digital subscriber lines (HDSL).
- ATM xDSL services are supported in the *AnyMedia* Access System using ATM cell transfer. In the current release of the *AnyMedia* Access System, ATM xDSL services include ADSL, SDSL, and SHDSL.
- The term *pack* is generally used for circuit packs in the *AnyMedia FAST* shelf (COMDAC and AFM) or in the ONU shelf (OCP, RGU, PRU, PFU and LVD), and also for all application packs.
- The term *application pack* is generally used for the packs in the *AnyMedia FAST* shelf and also in the ONU shelf that are located in any of the AP slots of the *AnyMedia* Access System (APs for POTS, ISDN, and ATM xDSL).
- In this manual the subscriber interface for analog POTS is tip/ring (T/R) interface.
- DS1 interface refers to the 1.544-kbps digital feeder interfaces of the narrowband system on the network side of the *AnyMedia FAST* shelf.
- DS3 interface refers to the digital feeder interface of the broadband system that carries the ATM payload cells. The DS3 interface is provided by the ATM feeder multiplexer AFMDS3.
- DS3 interface refers to a bit rate of 44.736 MBps and a framing according to ITU-T recommendations G.804, I.432 and ANSI T1.107, without specifying the physical interface.

- The term DSX-3 interface refers in the *AnyMedia FAST* shelf only to everything that DS3 refers to with the addition of a specific physical interface according to Telcordia standard GR-499.
- ADSL line refers to the twisted copper pair carrying ATM xDSL services.
- *xDSL service* means any broadband service transmitted over twisted pairs. Examples are ADSL, SDSL, and SHDSL.
- ADSL modem means the ADSL data circuit-terminating equipment at the customer's site.
- The *AnyMedia* graphical system interface software (GSI) provides one graphical user interface for narrowband and ATM xDSL services to one *AnyMedia* Access System.
- TL1 system interface (TL1SI) means any interface for operations using TL1 commands.
- A trademark is not treated as an acronym (it is not spelled out or expanded).

Acronyms and abbreviations

In the text, acronyms are expanded the first time they are used in the main text of a chapter (e.g., permanent leased line [PLL]). (See *List of Acronyms* at the end of this document.) Trademarked acronyms are not spelled out.

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- *AnyMedia* Access System Documents
  - 363-211-125, AnyMedia® Access System, *Ordering Guide* http://www.lucent8.com/library/AnyMediaOrderingGuide.pdf.
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363-211-103, AnyMedia® Access System, *Documentation*. This is a CD-ROM that contains the following documents in various formats:

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  - 363-211-106, AnyMedia® Access System, *Feature Supplement—MDS2 Shelf Configurations* (in PDF format)
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  - 363-211-129, AnyMedia® Access System, *ConnectReach™ Terminal User’s Guide* (in PDF format)
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Safety

1

Overview

The *AnyMedia*® Optical Network Unit (ONU) for outdoor applications is based on state of the art technology and fulfills current national and international safety requirements. It supports a high degree of operational safety resulting from many years of development experience and continuous stringent quality control.

This chapter lists the safety information applicable to the installation and cabling of the ONU for outdoor applications.

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Electrostatic Discharge

Electrostatic Discharge (ESD) Consequences

Semiconductor devices, and circuit packs in general, are sensitive to static charges. Most circuit pack integrated circuit (IC) damage can be attributed to a discharge of static electricity. Tests have shown that ICs can be damaged by discharges of less than 100 volts. For a person to feel the discharge of static electricity, a minimum level of 3500 volts must exist. A person walking across a floor can generate electrostatic voltages in excess of 5000 volts.

NOTE:
Since ESDs contain little or no current, there is no employee safety hazard.

In addition to ESD resulting from an ungrounded person touching a circuit pack, static discharges may result from other sources. If a piece of plastic is placed near one end of a circuit pack lying on an insulated table top, the plastic can direct its charge into the circuit pack.

Identifying ESD damage can be difficult because in most cases, physical damage cannot be seen. A circuit pack which has been exposed to an ESD may:

- Not be affected, i.e., work perfectly with normal life expectancy
- Function normally, but with reduced life expectancy
- Function erratically at times
- Stop functioning altogether.

Electrostatic Discharge Protection Requirements

To reduce the possibility of ESD damage, use the following guidelines. Assemblies are usually equipped with grounding jacks to enable personnel to ground themselves using wrist straps while handling circuit packs or working on an assembly. The jacks for connection of wrist straps are located at each assembly and are labeled. When grounding jacks are not provided, an alligator clip adapter enables connection to bay frame ground.

- Inspect the antistatic wrist strap once a day for damage or when it is suspected that the wrist strap has been stressed. See Figure 1-1 on page 1-4 for a typical antistatic wrist strap.
- Before using the antistatic wrist strap, verify with a volt-ohmmeter that approximately 1 megohm resistance is present between the wrist strap frame connector and the wrist harness.
- The clip or plug connector of the wrist strap must be connected to a ground which is common with the circuit pack ground. Use the equipment bay or shelf ESD ground jack.

In an emergency, when a properly functioning wrist strap is not available at the job site, use the following “touch-ground” procedure for handling circuit packs containing electronic components.

- Always touch ground (exposed or bare) metal before handling a circuit pack in any way (i.e., inserting, removing, or storing). This must be done just prior to touching the circuit pack. Moving around will necessitate repeating this procedure. Note that painted surfaces are not good ground points.
- Handle circuit packs only by the faceplate or latch and by the top and bottom outermost edges. Never touch the components, leads, or connector pins.
- Put the circuit pack into an antistatic bag or carton immediately upon removing it from a frame.

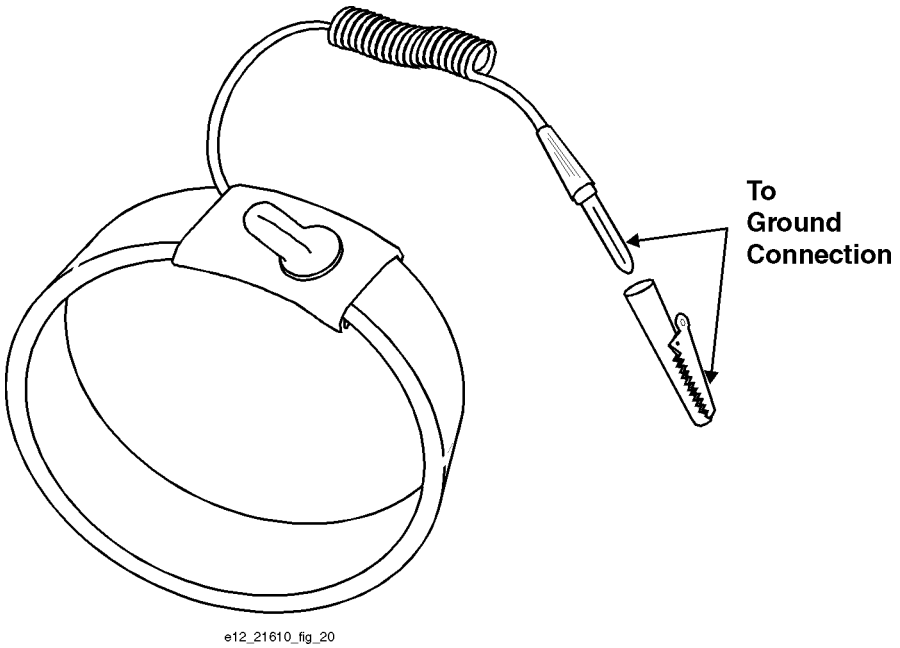

Figure 1-1 ESD Strap

CAUTION:
A grounded person must never hand an unprotected circuit pack to a person who is ungrounded. A static discharge from the ungrounded person through the circuit pack to the grounded person could cause an ESD induced failure. All persons and equipment at a work location must be at common ground potential to be static-safe.

Do not rub or wipe circuit packs containing ICs to clean them or their gold fingers unless both the individual and the circuit pack are the same ground potential.

Work areas must be kept clear of common plastics, a major source of static electricity. When rubbed or handled, these plastics produce a static charge that will not readily dissipate when grounded. These plastics must not make direct contact with ICs or circuit packs. Common plastic materials in this classification include polystyrene packing containers, clear plastic bags, plastic drinking cups, food wrappers, notebooks, and nonconductive plastic solder suckers. (The plastic insulation on small hand tools does not represent a static hazard.)

All circuit packs should be stored and transported in original factory packing materials whenever possible. Storage in frames or approved antistatic packaging is acceptable when factory packaging is unavailable.

An antistatic wrist strap must be used whenever a circuit pack with ICs is removed from, or inserted into, the frame or from its container.

Put the circuit pack into an antistatic bag or carton immediately after removing it from a frame. Keep adhesive tape (i.e., transparent or masking) away from the circuit packs.

Never place circuit packs on ungrounded metal shelving or on ungrounded portable carts without insulated surfaces.

Battery Safety

General precautions

Use the following basic precautions when handling batteries:

- Use only properly insulated tools and test equipment.
- Remove all metallic objects (key chains, glasses, rings, watches, or any other jewelry).
- Wear safety glasses, acid-resistant gloves, rubber overshoes and apron.
- Test circuits before touching.
- Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn-on. For the ONU these are the battery circuit breaker, the GMT-type fuse and the battery string cable connector on the low voltage disconnect unit (LVD) inside the rectifier shelf.
- Be aware of potential hazards before servicing equipment. A tool or other metallic object causing a short of the battery terminals may be thrown or vaporized due to the battery energy.
- Identify exposed hazardous electrical potentials on connectors, wiring, etc. (Note the condition of these circuits, especially any wiring).
- Always verify the polarity before connecting cables to the batteries.
- Use care when removing or replacing any covers; avoid contacting any circuits.

While unpacking and/or installing the batteries, never:

- place metal objects (including tools) on top of a battery.
- short out the battery's terminals.
- tamper with or block the battery vent caps, if equipped.
- use an open flame near batteries.
- smoke near batteries.
- stack batteries (in or out of their shipping cartons).

Hydrogen gas

All lead-acid batteries generate hydrogen gas, even under open circuit conditions. If not permitted to escape, this gas can build up to explosive concentrations. An explosion could occur when sparks are created near the battery string. Therefore do not install batteries in totally sealed enclosures. During maintenance actions check the battery fan and that the ventilation opening in the battery compartment are free.

Battery terminals

Overtightening of the inter-battery connectors could strip the bolt and/or nut threads resulting in loose connections. Always consider the maximum torque specified by the battery manufacturer.

Taking voltage readings

Be very careful when taking voltage readings to prevent accidental grounding or shorting of leads during measuring operations. Connections at the meter must be secure and free of any possibility of touching or becoming grounded. Never remove connections at the meter end without first disconnecting the test leads from the battery. Remove test lead connections at the battery immediately after each reading is taken. Review the safety precautions.

Acid spill

If a large acid spill occurs, use agricultural or industrial lime instead of soda for neutralization before clean-up. If lime is not available, you may use baking soda. Wear eye protection devices and rubber gloves when using lime on electrolyte spills. Sprinkle the lime on the spillage; allow it to absorb the electrolyte, and then sweep it up and dispose of it in the proper manner. Wash hands and face thoroughly after clean-up.

Special Considerations for the Tyco IR-40EC Batteries

Tyco IR batteries are valve regulated rechargeable stationary lead-acid batteries which are conditioned at delivery. The IR-40EC battery has recessed bolt type terminals and a hinged lifting handle which aids the battery installation and prevents shorting terminals when the lifting handle is not used for lifting.

GMT-type fuse

The GMT-type fuse in the low voltage disconnect unit (LVD) can produce sparks during interruption or clearing of a fault on a high energy circuit. Use only GMT-type fuses delivered by Lucent Technologies.

The IR-40EC batteries are provided with a 14AWG assembly terminating with 2 position AMP polarized connector. The standard cable assembly mounted to the IR-40EC batteries is designed for charging currents below 15 A. Charging currents exceeding 18 A will destroy the cable.

If the battery is charged externally the charging current of the external charger must not exceed 18 A under any circumstances if the delivered cable assembly is used.

Boost charging IR-40EC batteries

During boost charging water loss is increased and can result in premature failures caused by cell dry-out.

Boost charging the IR-40EC batteries is not recommended without the concurrence of Tyco. Refer to the Product Manual for IR-30EC and IR-40EC Batteries, Section Operations.

Sulfuric acid

The batteries contain sulfuric acid gel which may cause corrosion to skin. In the event of electrolytic contact with the skin, remove the electrolyte immediately by rinsing the affected area with large amounts of plain tap water.

In the event of electrolyte in the eye, pour water into the eye and allow at least one liter of water to run over the eye and under the eyelid. Eye injuries should be treated by a physician immediately.

General Safety Admonishments

Important General Safety Instructions

- Read and understand all instructions.
- Follow all warnings and instructions marked on the product.
- Do not place the shelves on an unstable cart, a stand, or a table. The product may fall causing serious damage to the equipment.
- Slots and openings in these shelves are provided for ventilation. To protect the shelves from overheating, these openings must not be blocked or covered. This equipment should not be placed in a built-in installation unless proper ventilation is provided.
- Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electrical shock. Never spill liquid of any kind on the product.
- For information on proper mounting instructions consult the appropriate section in this installation manual.
- Remove the desiccant from the shelf before inserting circuit packs.

Lightwave Safety

A Lucent Technologies lightwave digital transmission system and associated optical test sets use semiconductor laser transmitters. The lasers emit lightwaves, at or near infrared wavelengths, into lightguide cables. This light is at the red end of the visible spectrum.

Although, at present, the transmitter power levels are below those known to cause injury to the eye (for example, from a direct inadvertent exposure to the end of an energized fiber), direct exposure at close distances should be avoided.

CAUTION:
Never view any unterminated optical connector with optical instruments other than indirect image-converting devices such as the FIND-R-SCOPE, since viewing optics tend to collimate the energy from an optical connector and, hence, increase the potential risk for injury. Personnel performing these procedures must be trained in laser safety.*

* Registered trademark of FJW Optical Systems, Inc.

Product Safety

CAUTION:
Only trained service personnel should perform the procedures in this document. These procedures involve exposure to high electrical energy and/or current that may result in electric shock and/or injury to untrained personnel during servicing, maintenance and installation of this system.

Electrical Wiring Admonishments

Important Installation Safety Instructions

- Read and understand all instructions and warning labels.
- Installation and maintenance procedures must be followed and performed by trained personnel only. Do not allow non-service personnel to access electrical wiring.
- Voice frequency connections should be connected to telecommunication devices providing primary or secondary protection, as applicable.
- Never install telecommunication wiring during a lightning storm.
- Never install telecommunication connections in wet locations.
- Never touch uninsulated telecommunication wires or terminals unless the telecommunication line has been disconnected at the VF, DS1, DS3, test, or alarm interface.
- Never touch uninsulated wiring or terminals carrying direct current or ringing current or leave this wiring exposed. Protect and tape those wires and terminals to avoid risk of fire, electrical shock, and injury to service personnel.
- Use caution when installing or modifying telecommunication lines.
- This product should be operated only from the type of power source indicated on the marking label. For information on proper electrical distribution and power requirements, refer to the Application Schematic drawings that are mentioned in the Appendix A of this manual.
- To reduce the risk of electrical shock, do not reach into, touch anything inside, or disassemble this product. Service should be performed by trained personnel only. Opening or removing covers and/or circuit packs may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electrical shock when the unit is subsequently used.
- Use only Lucent Technologies manufactured *UL*† recognized circuit packs in this system.

† Registered trademark of Underwriters Laboratories, Inc.

ONU Product Description

2

Overview

The outdoor ONU is an extension of the *AnyMedia FAST* shelf. It enables telephony and ATM xDSL applications to be provided efficiently to remote business and residential communities. The ONU can be mounted on an outside wall, a pedestal, or a pole. It can be equipped with the same type of application packs (APs) as the *AnyMedia FAST* shelf and can provide the same narrowband and broadband services. This chapter briefly describes the principal ONU components.

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■ **Principal ONU Components**	2-2
Component descriptions	2-2
Component illustrations	2-2

Principal ONU Components

Component descriptions

The following components are or can be used in the ONU:

- Cabinet-type housing for wall/pedestal or pole mounting with most of the internal cabling:
  - — Separate electronics and battery compartments, accessible from the front door
  - — A termination compartment for cross-connect, fiber splicing, and AC distribution, accessible from the left-hand door
  - — A cabinet heat exchanger with ambient fan assembly on the right side of the cabinet, accessible for maintenance from the right via a removable cover
- Four IR-40EC batteries in the battery compartment with the optional fan unit. (Batteries are shipped separately.)
- An ONU shelf that holds the optical controller pack (OCP), the 8 application packs (APs), and the ringing generator unit (RGU). Packs and RGU are delivered separately.
- A rectifier shelf that holds the power rectifier unit (PRU) and the low voltage disconnect unit (LVD), with connectors for powering, alarming and feeding the fans on the rectifier backplane. (The PRU is shipped separately.)
- An internal cross-connect with 270 pairs for the feeder side and 180 pairs for the distribution side to the customer's equipment (distribution pairs are protected with protector magazines of cartridge type).
- An internal fiber splice/connect organizer for splicing/connecting up to six single fibers.
- An AC termination box with a surge arrestor for connection to AC power distribution systems.

An external power generator can be connected to the internal AC breaker panel.

Component illustrations

Figure 2-1 and Figure 2-2 show an equipped outdoor ONU.

Figure 2-1 Equipped outdoor ONU (front view)

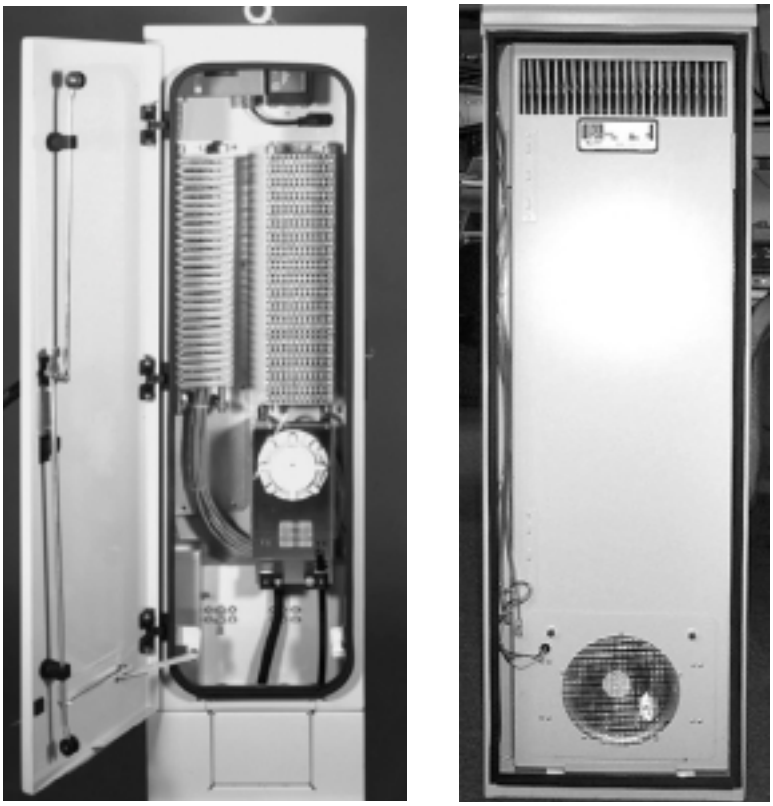

Figure 2-2 Side views of an equipped outdoor ONU (door open/cover removed)

Overview of the Installation Process

3

Overview

This chapter summarizes the ONU installation and cabling process and lists the tools and test instruments you will need to accomplish the installation.

Contents

	Page
■ **Installation Sequence**	3-2
■ **Tools and Measurement /Testing Instruments**	3-4

Installation Sequence

This manual covers the outdoor ONU installation process that starts with the preparation of the site ground. It is assumed that the any civil works (foundation construction) and cable runs to the ONU mounting area are complete.

The recommended installation sequence is as follows:

1. For pedestal mounted ONUs, install the site ground and pedestal and fasten the pedestal to the foundation pad.
2. Pull the cables for AC power, subscriber lines, and fibers through this pedestal.
3. Mount the Krone cross-connect inside the ONU termination compartment and cable it.
4. Mount and secure the ONU.
5. Immediately after mounting, ground the ONU to the site ground. Measure the ground resistance and ensure that it is less than the specified tolerance.
6. Route the cables through the termination compartment, ground them and seal them. Verify all cable grounds.
7. Route the fibers to the fiber splice box
8. Set the ONU number, mark the TAP100 test cable (if applicable), and interconnect the test application paths in the internal Krone cross-connect.
9. Connect the subscriber pairs to the distribution side of the Krone cross-connect. For POTS and ATM xDSL applications, make the cross-connections from the distribution side to the feeder side of the cross-connect.

NOTE:
For ATM xDSL-only applications, no cross-connections are required.

10. If ADSL APs are used for POTS and ATM xDSL applications, reroute POTS subscriber lines on the feeder side of the cross-connect.

NOTE:
For ATM xDSL-only applications, no rerouting is required.

11. Test the cross-connect cabling and equip all termination blocks on the distribution side of the cross-connect with protector blocks for primary protection.
12. Dress and splice the fiber at the ONU (and at the *AnyMedia FAST* shelf, if required).

13. Connect the AC cable from the utility side in the AC termination box (with the AC circuit breaker switched off).
14. Install the IR-40EC or IR-30EC batteries and connect them to the internal battery cable. Check all batteries and the battery and string voltages before installation.
15. Equip the rectifier shelf with the power rectifier unit (PRU) and with the low voltage disconnect unit (LVD).
16. If the ONU is expected to support POTS applications, install the PRU in the rectifier shelf.
17. Apply AC power and check the rectifier voltage.
18. Switch off the low voltage disconnect unit, connect the battery cable and the thermal probe cable to the PRU and turn on the LVD.
19. Charge the batteries for at least for 48 hours.
20. Equip the ONU shelf with the OCP and with APs, as instructed in *AnyMedia* Access System Commands and Procedures on-line documentation (363-211-103).

Tools and Measurement /Testing Instruments

The following is a list of suggested tools and test equipment needed to unpack the ONU and to complete its installation.

NOTE:
The equipment and/or materials required depends on the particular installation.

Table 3-1. List of tools and equipment

Use for	Tools	Remark
Basic	ESD wrist strap	
	Wire cutters (up to 6 mm^2) and strippers, diagonal cutting pliers, coated-wire stripping tweezer, multi-purpose knife, extension cable 5 m	
	Torque wrench (up to 70 inch-lbs; up to 7 Nm)	
	Hand tool kit: screwdriver sets for standard slotted, Pozidrive and Phillips, wrench sets (open-end/double hex, hexagon socket head/balend), universal and pointed pliers, flat and round file with handle, nut drivers, level (14 in or 350 mm) and back square, string tape measure/folding rule (8 ft or approx 2.4 m) etc.	
	Large tool kit: hammers, claw bar, etc.	
	8 inch/20 cm long flathead screwdrivers (slotted 4 mm and Phillips No. 1)	
	Waterproof fine line marker	
	Floor drilling equipment: roto-hammer or percussion drill with sintered-carbide/ stone drills (only if required)	
Batteries	Splash-proof safety goggles	Only if required
	Cleaning cloth	
	Protective gloves	
	Sandpaper or abrasive cloth	
	Insulated slip joint pliers (6-1/2 inch/16 cm)	
	Insulated socket driver or nut driver set (1/4-inch through 3/4-inch sockets)	
	Insulated combination wrench set (1/4-inch through 3/4-inch)	
	Insulated screwdrivers	

Table 3-1. List of tools and equipment (Continued)

Use for	Tools	Remark
Special: fiber, cabinet,... (only if required)	Lifting and transport equipment: hoists, dolly trucks, straps, etc.	
	Pinch bar, claw-type hammer and plate shears	
	Crimp tool for various connectors of ID type (D-sub)	
	Cable crimpers for 0.025 in^2 (16 mm^2)(for example for *Molex* connectors (No.: 11-01-197))	
	Heat-shrink gun	
	Soldering iron (70 W and 20 W) or soldering station with temperature control, solder tin and holder for soldering iron	
	Wire replacement/insertion tool for *Molex/Faston* connector pins	
	Fuse puller for GMT fuses (for example from Hendry Telephone Products or from Lucent: WP90247, Comcode 406420273)	
	Splice equipment with accessories (for example from Fujikura), Lucent 1040A Rotary Splice Tool kit to assemble mechanical splices, Lucent D181617 Rotary Splice Kit with consumable materials to complete 12 splices, Lucent D181755 PVC Buffer Tubing Kit for blocking cables and protecting up to 100 fibers, if required Lucent AT-8955 Index Matching Gel (2-part mix), prepacked isopropyl alcohol without additives (may be obtained locally)	For example and only if required, depending on fibers used
	Multi-layer tissues made from non-recycled cellulose or optical quality tissue/ lens cleaning paper (for example 9300-0761 from Hewlett-Packard), cotton swabs/Q-tips (for example 9300-1351 from Hewlett-Packard), adhesive cleaning tape (for example 15475-68701 from Hewlett-Packard), isopropyl alcohol without additives (may be obtained locally), pipe cleaner with soft bristles (for coupling cleaning) or fiber cleaning kit (for example kit 15475A from Hewlett-Packard)	Only if required and depending on fiber and fiber test equipment used
	Purified compressed air (for example spray can)	
	Optical microscope, enlargement greater than 40 up to 200, (for example type M10 from Wild or the FIND-R-SCOPE from FJW Optical Systems, Inc.)	For fiber checking only

Table 3-1. List of tools and equipment (Continued)

Use for	Tools	Remark
Test equipment (only if required)	DMM (Digital Multimeter) Tek DM254 or *Fluke* 8060A or equivalent (the accuracy of an equivalent meter should be 0.05 percent on the DC scale), insulated test leads with a diameter of 0.08 in (2 mm) for the probe tips are required for measurement via the battery connectors or via test jacks (on LVD)	
	DC current converter or current probe 1:10 for multimeter used for up to 20 A	Only if required. The reflectometer is mostly used for preparing for acceptance test of the complete fiber cabling.
	Test load of 48 V, 10 A (additional only)	
	Thermometer for ambient temperature measurement	
	Contact thermometer for battery temperature measurement	
	Test equipment for drop test/physical line testing (in the U.S., e.g. ITE-6675 Streak Mate, ITE-7079 AIU Test Fixture; additional only)	
	Fiber test equipment/optical power meter (1310/1550 nm); for example: *Wavetek* OLP-6 or OLP-15B (optical power meter for fiber receiver); *Wavetek* OLS-6 or OLS-15 (optical light source for fiber transmission). Reflectometer *Wavetek* MTS5100 (optical time domain reflectometer),	

Site Ground for Pedestal Mounted ONUs

4

Overview

This chapter addresses the site grounding requirements and recommended connections for a pedestal-mounted ONU. This chapter does not apply to pole-mounted or wall-mounted ONUs.

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	Page
■ **Site Ground Requirements**	4-2
■ **Recommended Connections**	4-3

Site Ground Requirements

In order for the ONU to operate reliably and safely, it must be connected to an appropriate site ground. The design of the site ground should conform to local practice and be based on the following principles:

- The ONU should never be operated with a disconnected ground.
- The installation must have an independent ground connection to an approved ground electrode for outdoor applications. The minimum size of the independent ground connection should be ≥ 0.025 in^2 (16 mm)^2 or ≤ 6 AWG. Adhere to the ITU recommendation ITU-K.35.
- A minimum of two ground rods driven into the ground are required, one at each end of the ONU housing. When driven, the rods should be flush with or slightly below ground level to enable inspection of the attached conductor.
- Grounding wires connected to the approved ground terminal should be available before you begin the installation of the ONU.
- The ground wire from the left side of the ONU (termination side) should be terminated at one of the grounding studs. This wire should be run as directly as possible and terminated, unspliced, to the ground rod (see Figure 4-1). The lug should be crimped; soldering is **not** allowed. The use of a double-hole lug is mandatory.
- The ground wire from the right side of the ONU should also be terminated at one of the grounding studs.
- The ground wire from the AC termination box of the ONU housing should be connected to one of the cabinet grounding studs located at the bottom of the side compartment.
- All cable sheaths of the external outdoor cables must be correctly connected to the cabinet grounding studs immediately after the housing is installed.
- When installing ground wires in a conduit, you must use non-metallic conduit.
- For installations involving multiple cabinets, the cabinets should be interconnected by 16 mm^2 solid copper ground wires of minimum length. Where cabinets or pedestals are separated by less than 6 ft (1.8 m), they can share a common centrally located ground rod. See Figure 4-2 for a typical grounding arrangement.

Recommended Connections

The two figures below illustrate the recommended ONU grounding connections.

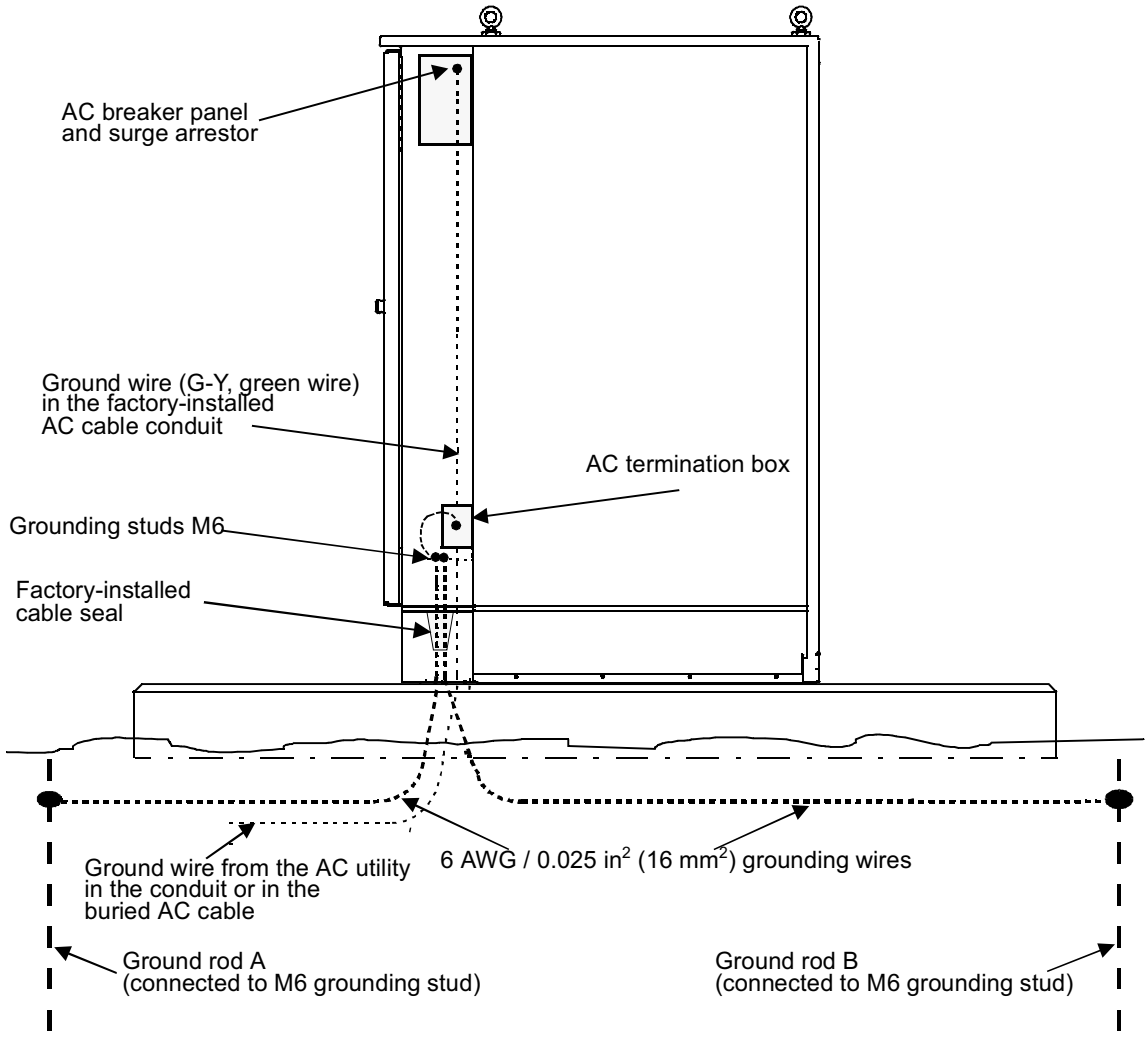

Figure 4-1 Grounding requirements for the ONU for outdoor installation

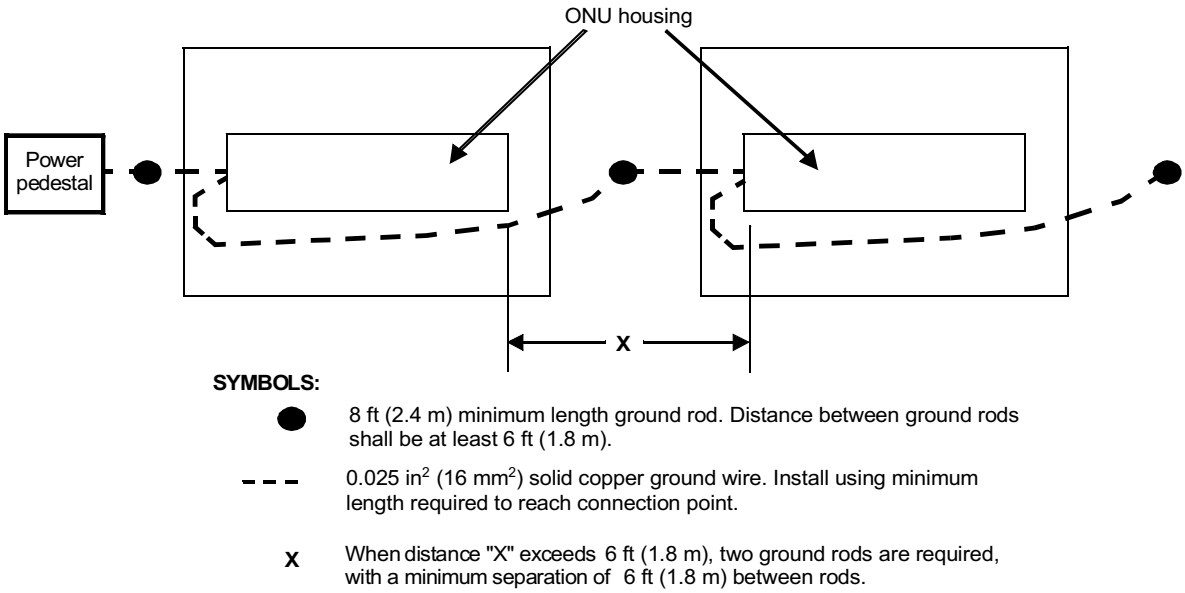
ONU housing
Power pedestal
X
SYMBOLS:
8 ft (2.4 m) minimum length ground rod. Distance between ground rods shall be at least 6 ft (1.8 m).
0.025 in² (16 mm²) solid copper ground wire. Install using minimum length required to reach connection point.
X
When distance "X" exceeds 6 ft (1.8 m), two ground rods are required, with a minimum separation of 6 ft (1.8 m) between rods.

Figure 4-2 Grounding requirements for a multiple ONU installation

Mounting the ONU

5

Overview

This chapter describes the procedures for mounting the cross-connects in the ONU termination compartment; for mounting/installing the ONU; and for connecting it to the site ground. These mounting procedures must be performed before you connect any external cables to the ONU or power-up the system.

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Installing the TAP-B cable (option)	5-11
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Positioning and securing the ONU	5-18
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Installing the ONU on the pole 5-27

Mounting and Installing the Optional Cross-Connect

This section provides requirements and procedures for mounting and installing a Krone cross-connect (two types are available) in the ED7C851-50 Grx ONU base housing.

NOTE:
When mounting the ONU on a wall or pole it is advisable to pre-install the Krone cross-connect and all optional delivered parts while the ONU housing is still on the ground to simplify installation.

Cross-connect alternatives

The Krone cross-connect is available in either of two configurations:

- For xDSL-only applications:
  - — Krone cross-connect kit ED7C851-56 Gr.3 with a combined feeder/distribution side having 27 disconnection modules (type 2/10; top/bottom access)
- For combined POTS and xDSL applications:
  - — **Feeder side.** Krone cross-connect kit ED7C851-56 Gr.1 with 27 high density connection modules (type 10/10; front/rear access)
  - — **Distribution side.** Krone cross-connect kit ED7C851-56 Gr.2 with disconnection modules (type 2/10; top/bottom access)

Figure 5-1 illustrates each type of Krone cross-connect configuration. Note that the xDSL-only configuration (left side of Figure 5-1) has one long cross-connect block, while the combined POTS/xDSL configuration (right side of Figure 5-1) has two shorter cross-connect blocks (designated the Feeder Cross-connect and Distribution Cross-connect).

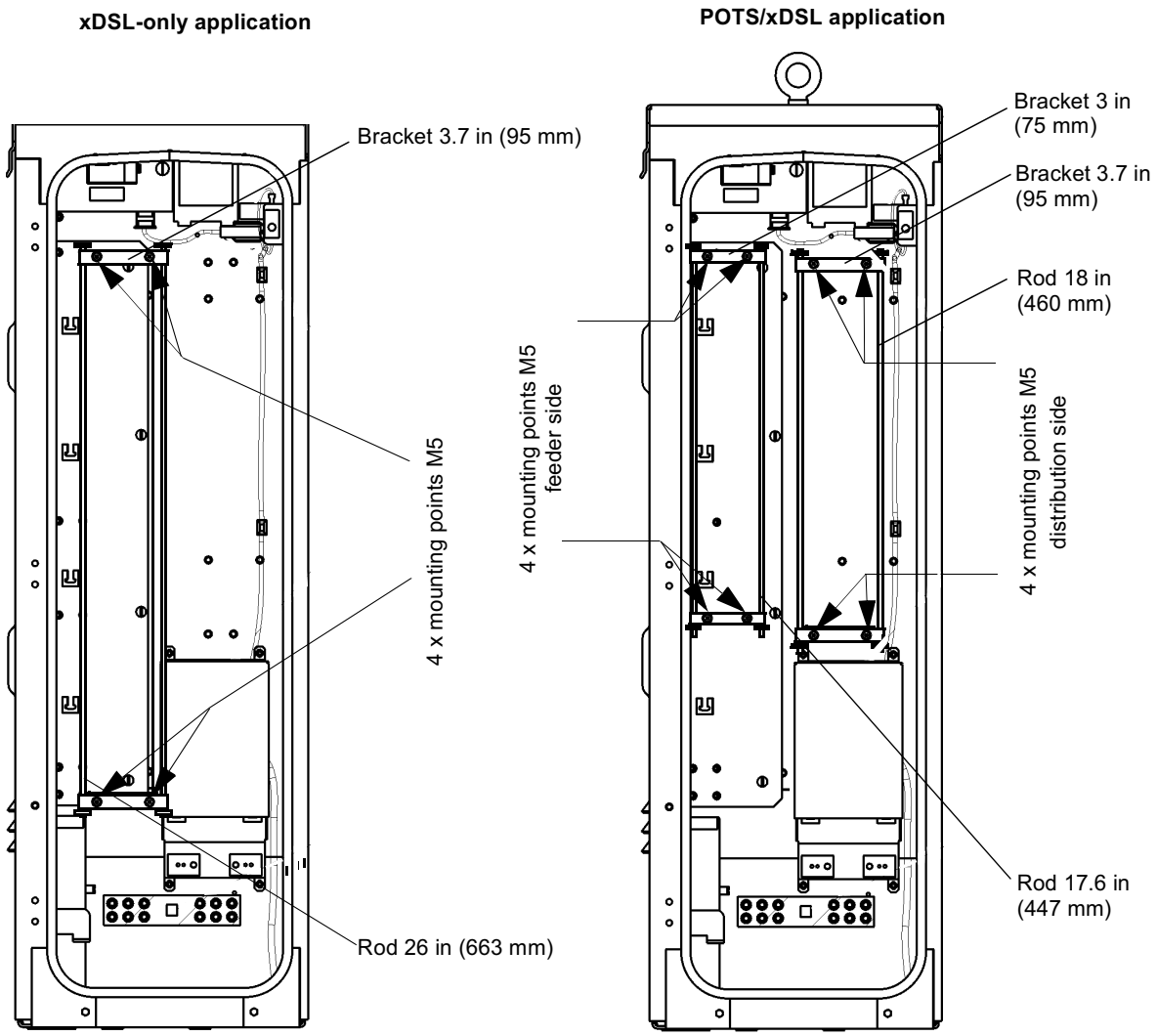
xDSL-only application
POTS/xDSL application
Bracket 3.7 in (95 mm)
4 x mounting points M5
Rod 26 in (663 mm)
Bracket 3 in (75 mm)
Bracket 3.7 in (95 mm)
Rod 18 in (460 mm)
4 x mounting points M5 feeder side
4 x mounting points M5 distribution side
Rod 17.6 in (447 mm)

Figure 5-1 Mounting points for the cross-connect configurations

To mount the Krone cross-connect, proceed as follows:

Step 1. Open and latch the door of the termination compartment.

Step 2. Verify that the eight tip/ring (T/R) cables coming from the APs have been pre-installed (at the factory) and that they are routed and attached to the cross-connect support bracket on the left side of the termination compartment.

Step 3. Dress the T/R-cables as shown in Figure 5-2, page 5-5 so that they can be easily connected later to the cross-connect modules.

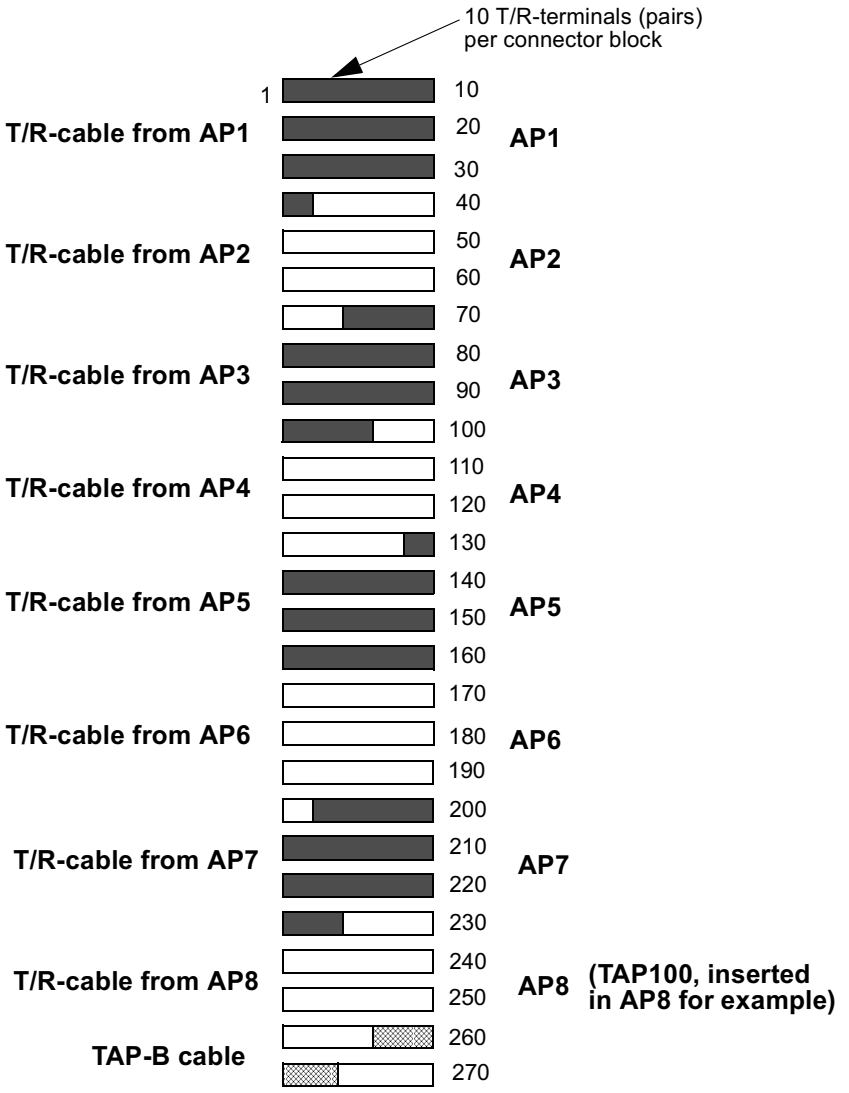

Figure 5-2 Cross-connect, cable routing/wiring for xDSL-only installations or the feeder side of combined POTS/xDSL installations

Note that both the cross-connect for xDSL-only applications (which is 26 in (663 mm) long) and the feeder side of the cross-connect for combined POTS/xDSL applications (which is 17.6 in (447 mm) long) each contain 27 cross-connect modules, so that the dressing of the T/R cables should be in accordance with the diagram in Figure 5-2, regardless of which application is installed.

Step 4. If you are mounting the ED7C851-56 Gr.3 Krone cross-connect for xDSL-only applications, skip to Step 18.

Step 5. For combined POTS/xDSL applications locate the ED7C851-56 Gr.1/Gr.2 Krone cross-connect kit with the brackets and rods as follows:

a. For the feeder side: two 3 in (75 mm) rod brackets and two 17.6 in (447 mm) rods

b. For the distribution side: two 3.7 in (95 mm) rod brackets and two 18 in (460 mm) rods

Step 6. Refer to the equipment configuration illustrated on the right-hand side of Figure 5-1, page 5-4. Using four M5 screws, install the rods and brackets on the cross-connect support bracket located on the left-hand side of the termination compartment.

Step 7. Install the grounding set at the bottom of the 3 in (75 mm) bracket and connect the enclosed grounding wire to one of the M6 grounding studs.

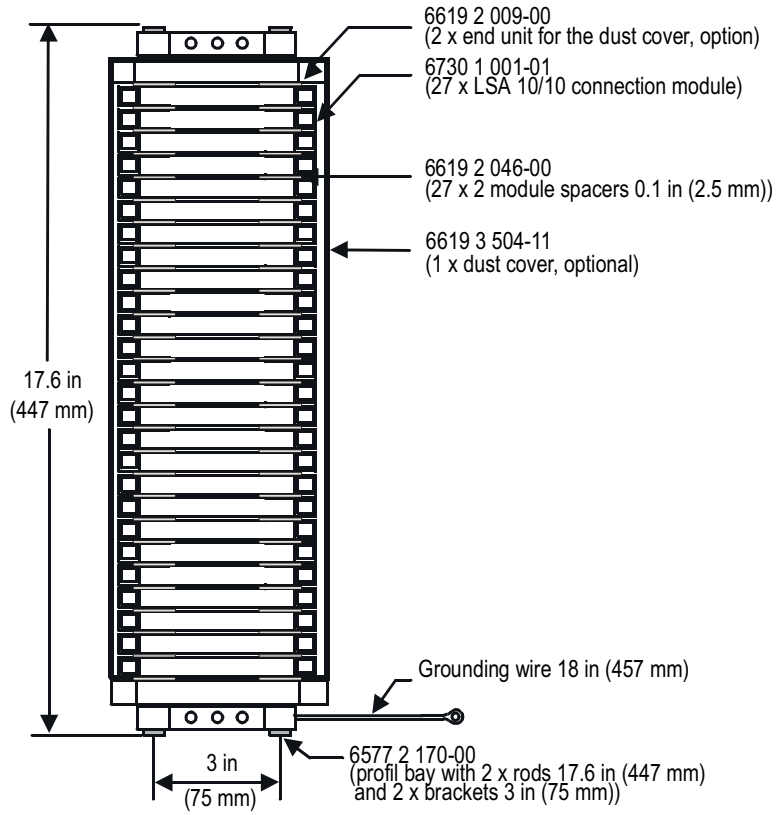
6619 2 009-00
(2 x end unit for the dust cover, option)
6730 1 001-01
(27 x LSA 10/10 connection module)
6619 2 046-00
(27 x 2 module spacers 0.1 in (2.5 mm))
6619 3 504-11
(1 x dust cover, optional)
17.6 in
(447 mm)
Grounding wire 18 in (457 mm)
6577 2 170-00
(profil bay with 2 x rods 17.6 in (447 mm)
and 2 x brackets 3 in (75 mm))
3 in
(75 mm)

Figure 5-3 Krone cross-connect ED7C851-56 Gr.1 for POTS/xDSL applications, feeder side

Step 8. Locate the 30 10/10 LSA PLUS high density connection modules (6730 1 001-01, 10 per set are delivered) and the 100 module spacers (6619 2 046-00). Install 27 connection modules and 54

spacers on the feeder side (the side with the 3 in (75 mm) wide bracket), as shown in Figure 5-3, page 5-6.

Mount each module with Terminal 1 on the left and the white-colored side of the module faces front.

Step 9. If you have an optional dust cover (6619 3 504-11), install the two end units (6619 2 009-00) and attach the cover.

Step 10. Using four M5 screws, install the 3.7 in (95 mm) brackets and the two 18 in (460 mm) rods on the right side of the back panel, as shown in Figure 5-1, page 5-4, right-hand illustration.

Step 11. Install the grounding set at the bottom of the 3.7 in (95 mm) bracket and connect the enclosed grounding wire to one of the M6 grounding studs.

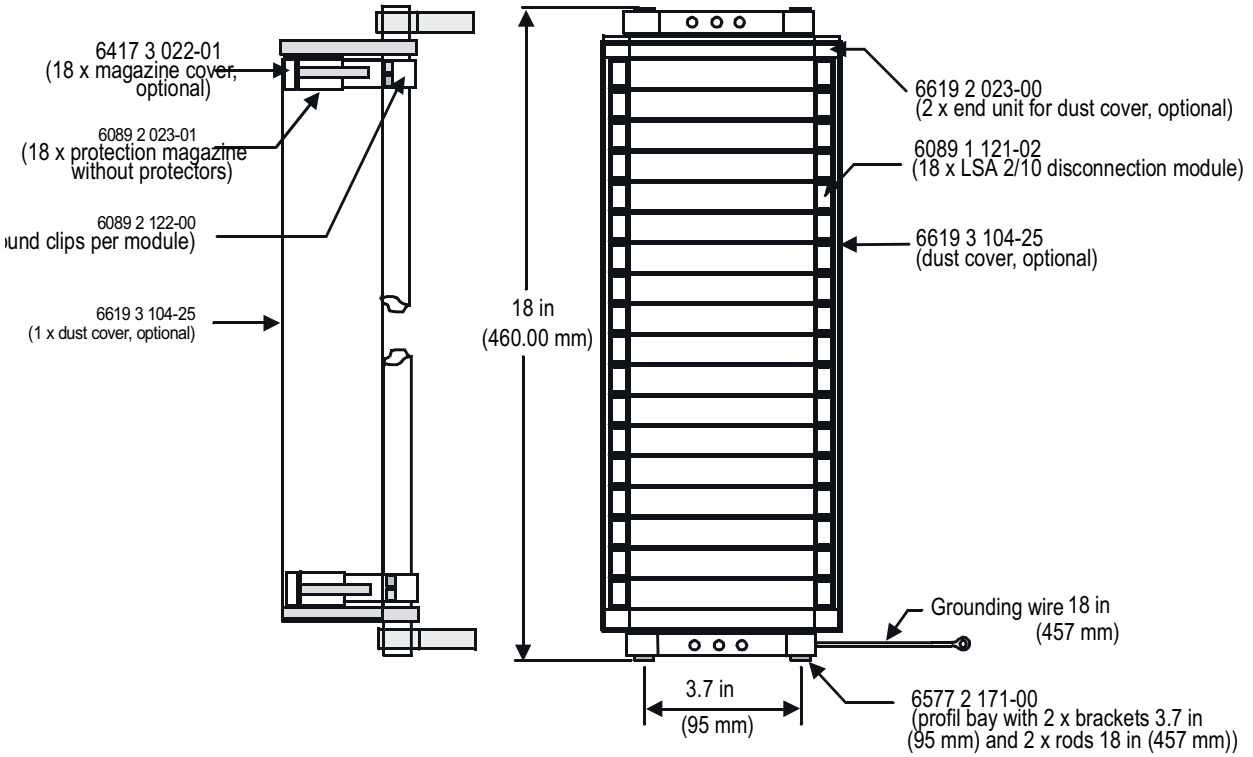
6417 3 022-01
(18 x magazine cover, optional)
6089 2 023-01
(18 x protection magazine without protectors)
6089 2 122-00
und clips per module)
6619 3 104-25
(1 x dust cover, optional)
18 in
(460.00 mm)
6619 2 023-00
(2 x end unit for dust cover, optional)
6089 1 121-02
(18 x LSA 2/10 disconnection module)
6619 3 104-25
(dust cover, optional)
Grounding wire 18 in
(457 mm)
3.7 in
(95 mm)
6577 2 171-00
(profil bay with 2 x brackets 3.7 in
(95 mm) and 2 x rods 18 in (457 mm))

Figure 5-4 Krone cross-connect ED7C851-56 Gr.2 for POTS/xDSL applications; distribution (right-hand) side

Step 12. Locate the 20 2/10 LSA PLUS disconnection modules (6089 1 121-02, 10 per set are enclosed) and the 40 ground clips (6089 2 122-00, 20 per set are enclosed). Insert two grounding clips into each 2/10 module and install 18 disconnection modules with 36 ground clips on the distribution side (the side with the 3.7 in

(95 mm) bracket)) as shown in Figure 5-4, page 5-7. (Two of the disconnection modules are spares.)

Step 13. Locate the 18 protection magazines (6089 2 023-1) and equip each magazine with 10 3-point arrestors (6717 3 513-00).

Alternatively, a completely assembled protection magazine (6089 2 23-08) is available.

Step 14. If you have received the optional magazine cover (6417 3 022-01), equip each magazine with the cover.

Step 15. Equip each disconnection module with a protection magazine.

Step 16. If you have received the optional dust cover (6619 3 104-25), install the two end units (6619 2 023-00) and attach the cover.

Step 17. This completes the installation of the cross-connects for POTS/xDSL applications. Proceed to Step 25.

Step 18. For xDSL-only applications, locate the ED7C851-56 Gr.3 Krone cross-connect kit with the brackets and rods to be mounted on the left side. The kit contains:

a. two 3.7 in (95 mm) rod brackets

b. two 26 in (663 mm) rods

Step 19. Using four M5 screws, install the two 3.7 in (95 mm) brackets and the two 26 in (663 mm) rods on the cross-connect support bracket located on the left side of the termination compartment, as shown in Figure 5-1, page 5-4.

Step 20. Locate the 30 2/10 LSA PLUS disconnection modules (6089 1 121-02, 10 per set are enclosed) and the 60 ground clips (6089 2 122-00, 20 per set are enclosed). Insert two grounding clips into each 2/10 module and install 27 disconnection modules with the 56 ground clips on the distribution side (the side with the 3.7 in (95 mm) bracket) as shown in Figure 5-5, page 5-9. (Three of the disconnection modules are spares.)

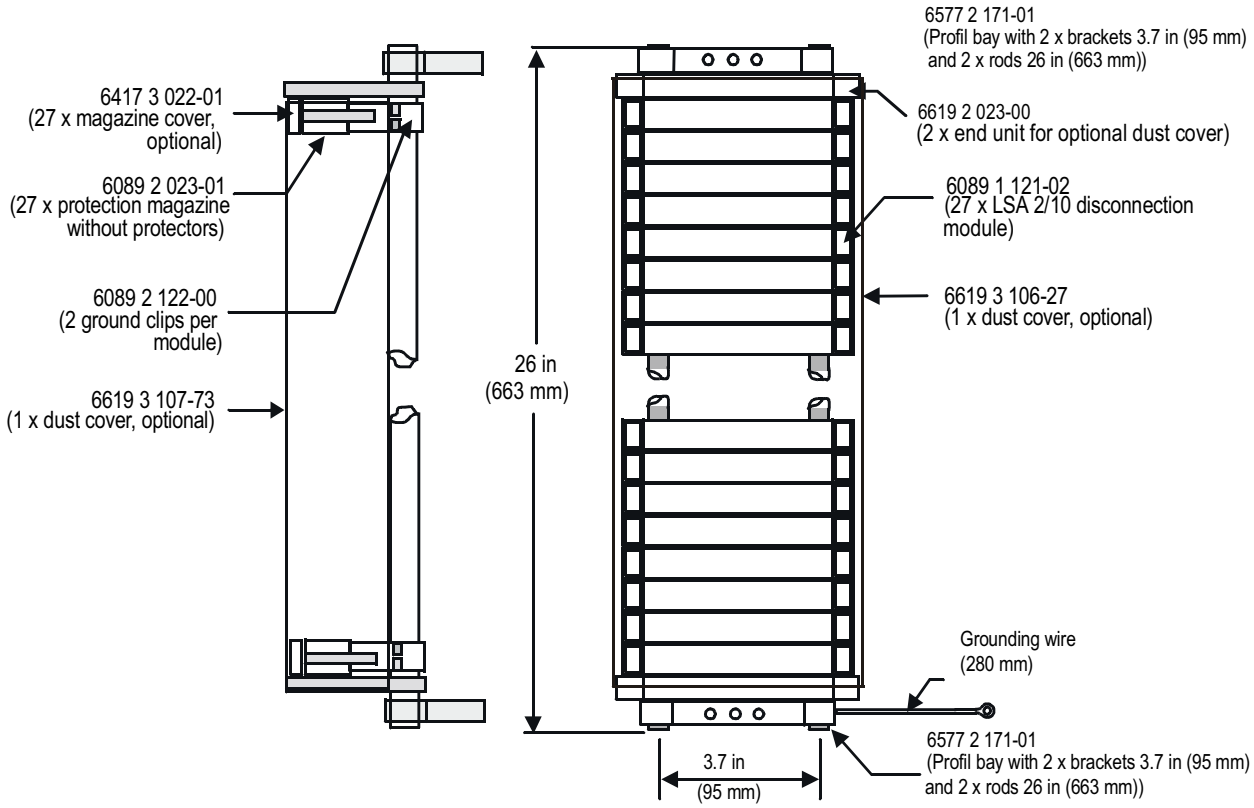
6577 2 171-01
(Profil bay with 2 x brackets 3.7 in (95 mm)
and 2 x rods 26 in (663 mm))
6619 2 023-00
(2 x end unit for optional dust cover)
6089 1 121-02
(27 x LSA 2/10 disconnection module)
6619 3 106-27
(1 x dust cover, optional)
6417 3 022-01
(27 x magazine cover, optional)
6089 2 023-01
(27 x protection magazine without protectors)
6089 2 122-00
(2 ground clips per module)
6619 3 107-73
(1 x dust cover, optional)
26 in
(663 mm)
Grounding wire
(280 mm)
6577 2 171-01
(Profil bay with 2 x brackets 3.7 in (95 mm)
and 2 x rods 26 in (663 mm))
3.7 in
(95 mm)

Figure 5-5 Cross-connect for xDSL-only applications

Step 21. Locate the 27 protection magazines (6089 2 023-1) and equip each magazine with 10 3-point arrestors (6717 3 513-00).

Alternatively, a completely assembled protection magazine (6089 2 23-08) is available.

Step 22. If you have received the optional magazine cover (6417 3 022-01), equip each magazine with the cover.

Step 23. Equip each disconnection module with a protection magazine.

Step 24. If you have the optional dust cover (6619 3 106-27), install the two end units (6619 2 023-00) and attach the cover.

Step 25. Locate the pre-installed copper subscriber cable and attach it at the right side of the cross-connect for later connection.

Connecting T/R-cables for the base housing configuration

The procedure below explains how to connect the pre-installed T/R-cables (848573341) used for POTS, ISDN, and ATM xDSL to the feeder side of the internal Krone cross-connect. This procedure is only required if you are installing the ED7C851-50 Grx ONU base housing, which is not factory equipped with the Krone cross-connect.

The T/R-cables are approximately 10 ft (≈ 3 m) long. At one end, they are connected to the blank faceplates (C 847773389) on the ONU shelf; at the other end, they are attached to the cross-connect support bracket on the left side of the termination compartment.

Preparation

If not factory prepared, all T/R-cable connectors should be manually marked by the installer in accordance with the route/system numbering scheme. The MDF circuit labeling should follow this numbering pattern.

Assignment

Figure 5-2 on page 5-5 provides an example of the cross-connect assignments for a Krone cross-connect with 10 T/R-terminals per connector block. Note that this connector block is also used to connect the TAP-B cable (see “Installing the TAP-B cable (option)” on page 5-11). In this illustration, seven pairs of terminals 257 to 270 (shown cross-hatched) on the feeder side of the internal cross-connect are used.

Procedures for installing and attaching the T/R-cables

Install the T/R-cables as follows.

Step 1. Dress the T/R-cables as indicated in Figure 5-2 so that they can easily connected to cross-connect modules.

Step 2. Locate the T/R-cable (should be labeled AP1) attached to the blank faceplate of the AP-1 slot.

Step 3. Remove the cable sheath to allow pairs 1 to 10 to dress above module 1, pairs 11 to 20 above module 2, pairs 21 to 30 above module 3 and pairs 31 and 32 above module 4.

Step 4. Using the Krone insertion tool (6417 2 055-01), press the first 10 pairs into the connecting slots of module 1 and trim any access wire. It is recommended that the modules are wired with the a-wire (Tip) terminated on the left position of each connecting pair of the module when viewed from the front.

References: See the *AnyMedia* Access System Installation Manual, 363-211-102, for connector wiring diagrams.

NOTE:
If you connect to the LSA PLUS 10/10 high density modules, the backward cabling from the APs connects to the white side of this module.

If you connect to the LSA 2/10 modules (for xDSL-only cross-connect), the T/R cable from the APs connects to the top (black-marked) connection row of the module.

NOTE:
After installation there should be only enough slack wire to enable the cross-connect module to pivot enough to provide access to the rear of the modules. If required, remove modules below the module you are working on to avoid interference.

Step 5. Continue connecting pairs 11 through 20, pairs 21 through 30 and pairs 31 and 32 to modules 2, 3 and 4.

Step 6. Repeat steps 3 through 5 for the other seven T/R cables from the APs, using the appropriate modules.

Step 7. Test the T/R-cabling according to local regulations and practices.

Requirement: There should be no open or shorted wires or tip/ring reversals.

Step 8. For the feeder side of the ED7C851-56 Gr.1 cross-connect (for POTS/xDSL) pivot each LSA PLUS 10/10 high density connection module so that the gray unconnected side shows to the front and the connection slots for pair 1 (marked by a “1”) are on the left side.

Installing the TAP-B cable (option)

This procedure consists of connecting the prefabricated TAP-B cable to the cross-connect.

Cable Description

The TAP-B cable (848569257) is used in for drop testing. It has 12 wires and is 10 ft (≈ 3 m) long. One end is attached to the cross-connect support bracket on the left side of the termination compartment. The other end is connected to the 37-pin D-sub connector C1 (marked TAP) on the ONU shelf. Not all pins on this 37-pin connector are connected; only 4 wires are required for integrated drop testing and monitoring. These wires must be connected at the cross-connect to the 4 wires (circuits 1 and 2) of the TAP100 cable. The fifth wire is reserved for future use (seizing).

If not factory prepared, the TAP-B cable should be marked manually by the installer in accordance with the route/system numbering scheme.

The wiring of the TAP connector for the TAP-B cable is shown in Table 5-1. This table illustrates the MDF connections for the TAP-B cable, as an example.

Table 5-1. Connections to the MDF (example), external cable 848569257 from ONU shelf, TAP-B connector to the cross-connect

TAP100[a]		TAP-B cable			
Cross-connection for TAP100 only!		***AnyMedia* signal of the TAP-B**	**Pin of TAP-B cable connector**	**Wire color [b]**	**Cross-connect (10 pins/ row)**
		-	1 to 12 not used	-	
		not used	(31, not connected)	W-BL	257a
		TAPB_SEIZE[c] (multiple testing)	13	BL-W	257b
		TAPB-EQ-T1	32	W-O	258a
		TAPB-EQ-R1	14	O-W	258b
225a (W-BL)	Equip-ment (port 1)	TAPB-EQ-T[d] = Tip 1 of TAP100	33	W-G	259a
225b (BL-W)		TAPB-EQ-Rd. = Ring 1 of TAP100	15	G-W	259b
226a (W-O)	Facility[e] (port 2)	TAPB-FAC-T[f] = Tip 2 of TAP100	34	W-BR	260a
226b (O-W)		TAPB-FAC-Rf. = Ring 2 TAP100	16	BR-W	260b
		TAPB-FAC-T1	35	W-S	261a
		TAPB-FAC-R1	17	S-W	261b
		TAPB-FAC-E	36	R-BL	262a
		TAPB-FAC-M	18	BL-R	262b
		TAPB-EQ-E	37	R-O	263a
		TAPB-EQ-M	19	O-R	263b
		-	20 to 30 not used	-	

a. Only the cross-connections are shown, for the TAP100 a normal T/R-cable is used with all 32 ports connected to the MDF.

b. Cable colors valid for the 848545398 cable.

c. For future use if the TAP100 is used for multiple NE testing (seizing multi-TAPs) or for multiple testing with the remote test unit (via wired OR), currently not used.

d. Used for crossconnecting to the test application path for Equipment (corresponds to R1/T1 of TAP100 (1st POTS port)).

e. For ISDN testing used.

f. Used for cross-connecting to the test application path for Facility (corresponds to R2/T2 of TAP100 (2nd POTS port)); required for ISDN testing for example.

TAP-B cable installation procedure

Install the TAP-B cable using the following procedure:

Step 1. If the TAP-B cable is pre-installed, skip to Step 8. Otherwise, proceed to Step 2.

Refer to Figure 5-6, Figure 5-7 and Figure 5-8.

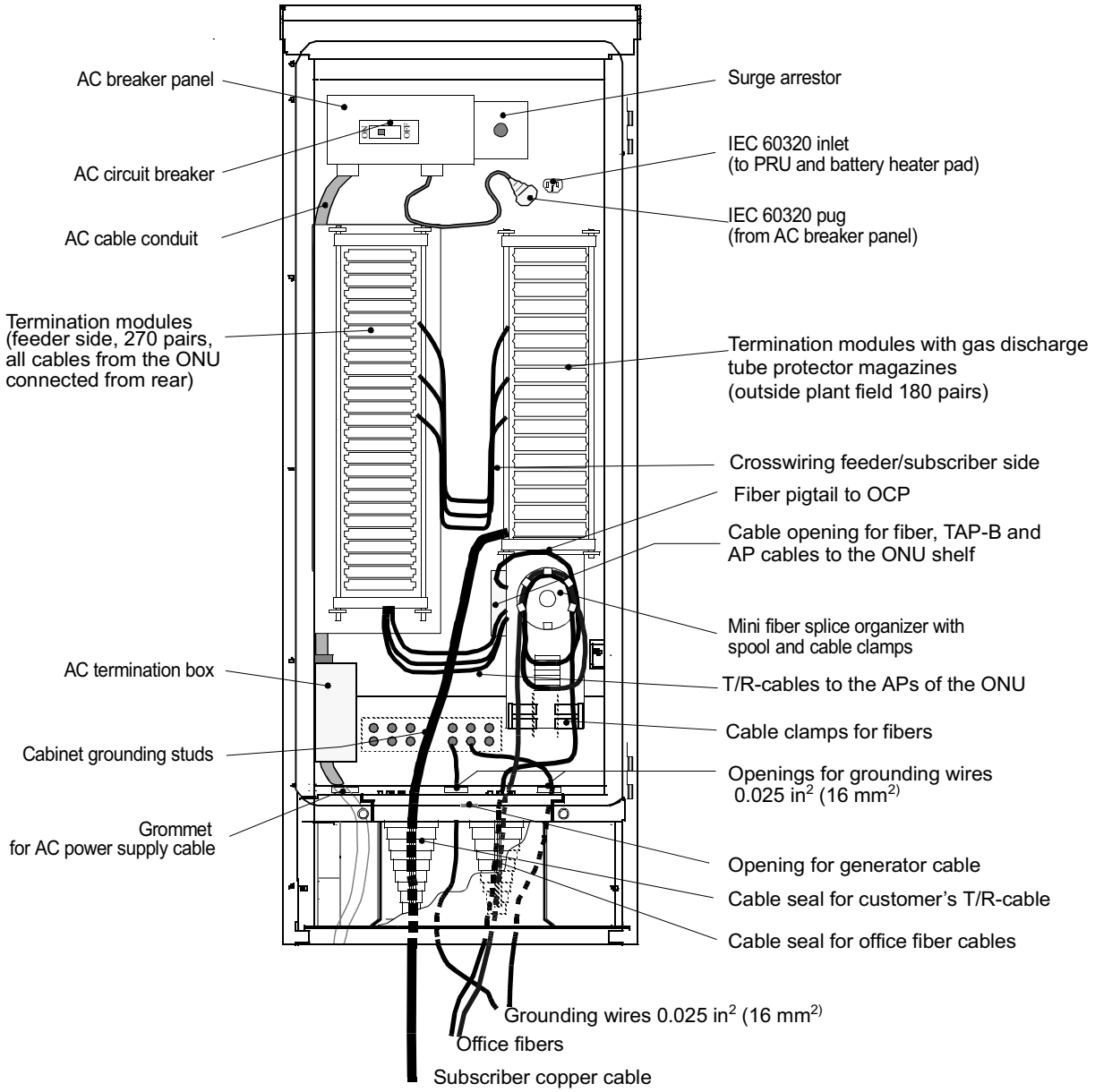
AC breaker panel
AC circuit breaker
AC cable conduit
Termination modules (feeder side, 270 pairs, all cables from the ONU connected from rear)
AC termination box
Cabinet grounding studs
Grommet for AC power supply cable
Surge arrestor
IEC 60320 inlet (to PRU and battery heater pad)
IEC 60320 pug (from AC breaker panel)
Termination modules with gas discharge tube protector magazines (outside plant field 180 pairs)
Crosswiring feeder/subscriber side
Fiber pigtail to OCP
Cable opening for fiber, TAP-B and AP cables to the ONU shelf
Mini fiber splice organizer with spool and cable clamps
T/R-cables to the APs of the ONU
Cable clamps for fibers
Openings for grounding wires 0.025 in2 (16 mm2)
Opening for generator cable
Cable seal for customer's T/R-cable
Cable seal for office fiber cables
Grounding wires 0.025 in2 (16 mm2)
Office fibers
Subscriber copper cable

Figure 5-6 Cable routing inside the outdoor termination compartment

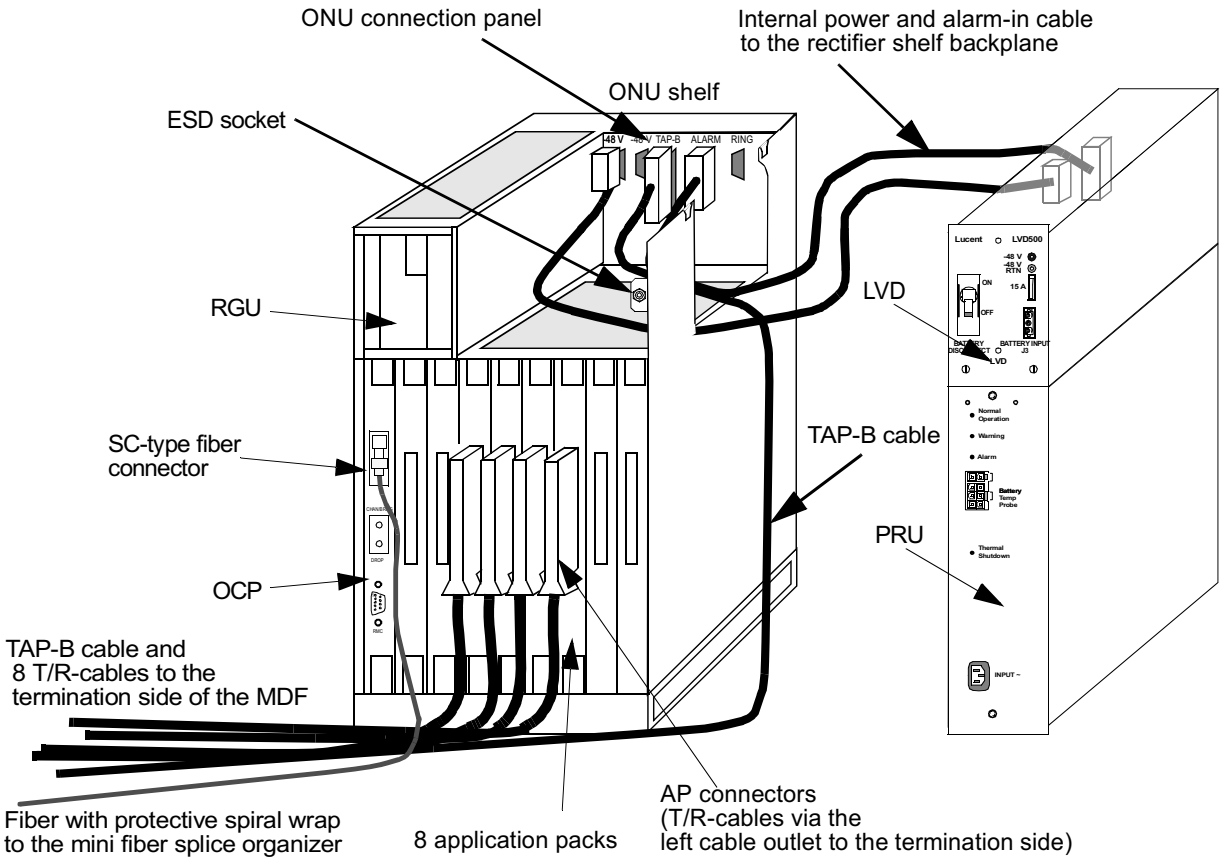

Figure 5-7 ONU shelf cabling arrangement

Step 2. Pull the connector end of the TAP-B cable assembly through the opening in the termination compartment directly above the fiber splice organizer (Figure 5-6). Route it along the bottom of the ONU shelf towards the gap between the rectifier shelf and the ONU shelf (Figure 5-7).

Step 3. Lead the cable in the gap upwards through the right opening of the ONU shelf to the 37-pin, male connector C1 (Figure 5-8).

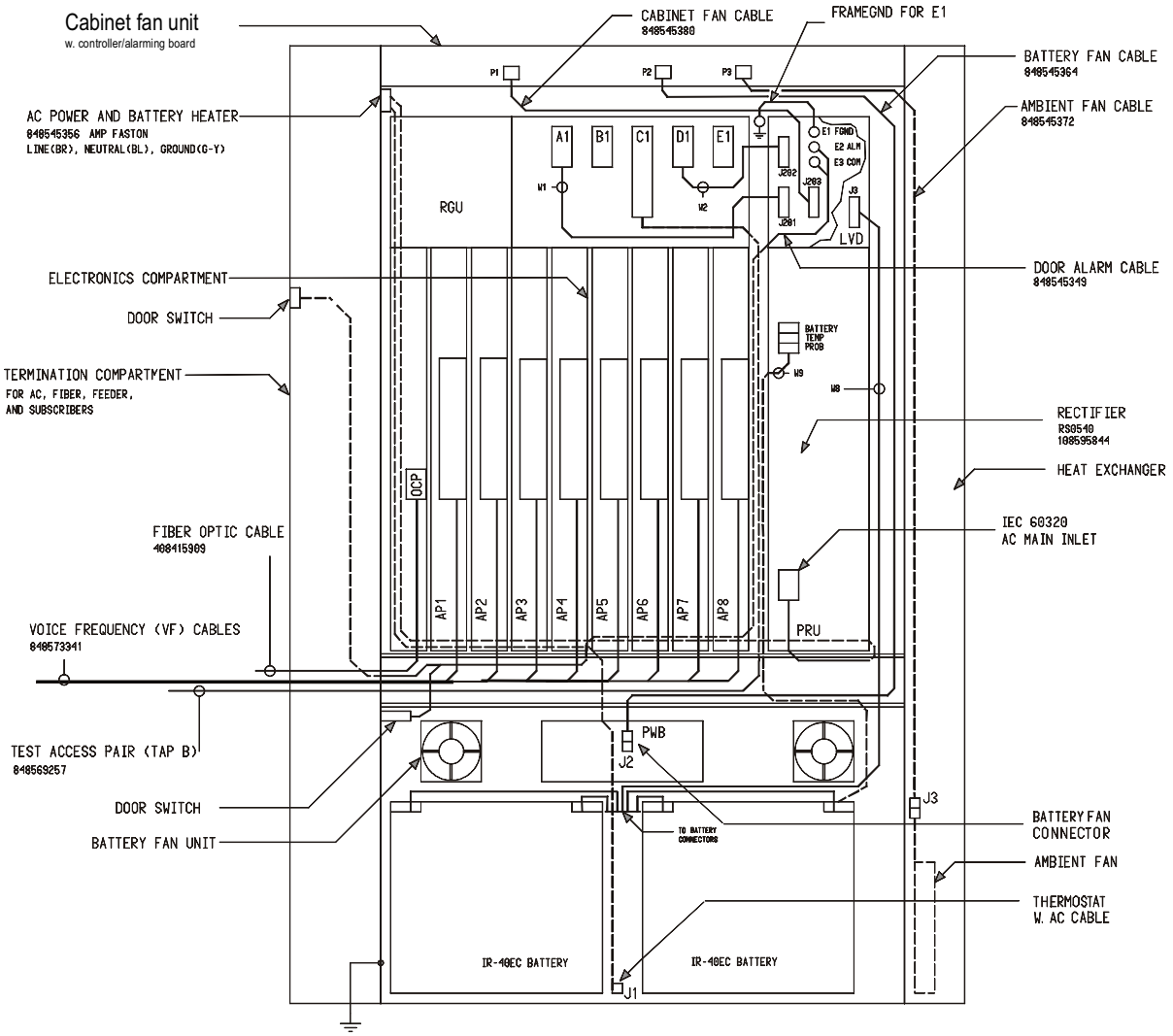

Figure 5-8 Cabling inside the electronics compartment

Step 4. Add cable ties to the rectifier shelf as needed to attach the TAP-B cable.

Step 5. Mate the TAP-B connector with connector C1 of the ONU shelf.

Step 6. Check the correct labeling on the cable connector and mark if required. Mark the other cable end in the area of the MDF with the same label designation.

Step 7. Attach the TAP-B cable with cable ties as needed to the (previously installed) T/R cables.

Step 8. Dress the TAP-B cable so that it can be connected to the lowest module of the feeder side of the cross-connect. Remove the cable sheath for about 8 in (20 cm).

Step 9. Connect the TAP-B cable to the cross-connect according to Figure 5-2, page 5-5 and Table 5-1., page 5-12.

NOTE:
The TAP-B cable is a 13-wire cable of which only 5 wires are used. Four of them are for the circuit pair and the drop pair of the metallic test path. The fifth is for future use. For the cabling/interconnections of the metallic test path, see Interconnecting the test application paths (option), page 7-16.

Step 10. Terminate the tip/ring pairs at the cross-connect and check the labeling. Note the wire color-coding sequence of the factory-prepared cable assemblies to facilitate the terminations.

Step 11. Test the TAP-B wiring according to local regulations and practices. There should be no open or shorted wires or tip/ring reversals.

Pedestal Mount

For ONUs that are to be mounted on pedestals, this section explains how to position and attach the pedestal to the foundation pad and how to mount the ONU.

Foundation pad cabling arrangement

Before installing the pedestal on the foundation pad, verify that the foundation pad cabling includes all the items illustrated in Figure 5-9.

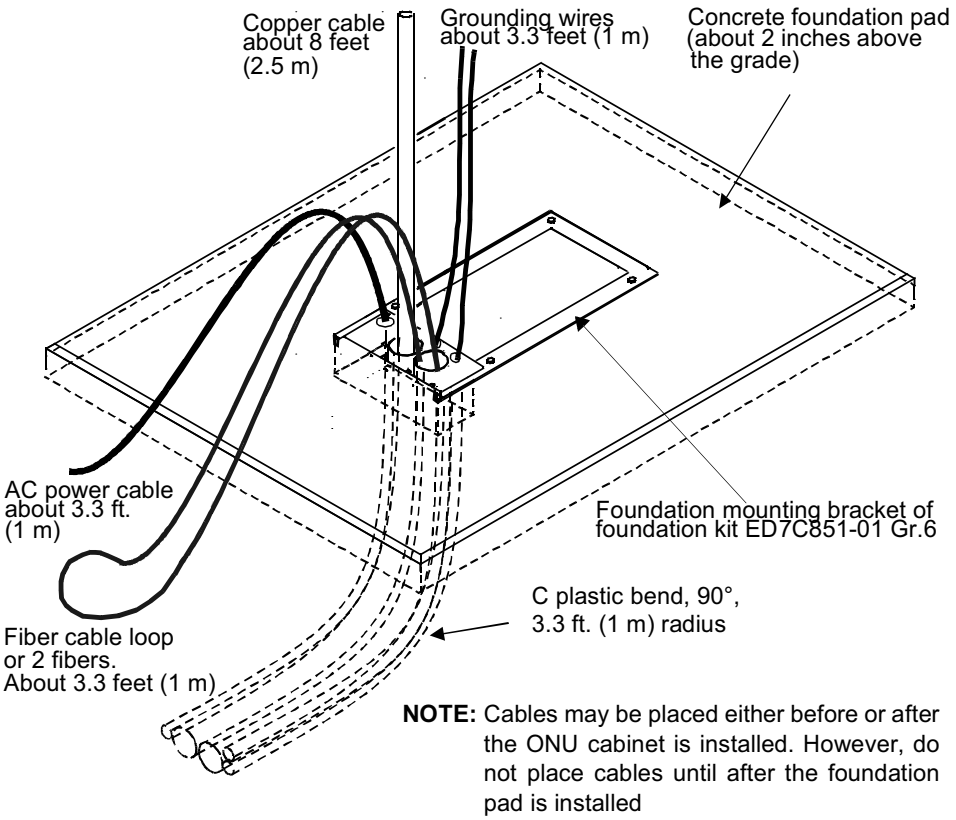
Copper cable about 8 feet (2.5 m)
Grounding wires about 3.3 feet (1 m)
Concrete foundation pad (about 2 inches above the grade)
AC power cable about 3.3 ft. (1 m)
Foundation mounting bracket of foundation kit ED7C851-01 Gr.6
C plastic bend, 90°, 3.3 ft. (1 m) radius
Fiber cable loop or 2 fibers. About 3.3 feet (1 m)
NOTE: Cables may be placed either before or after the ONU cabinet is installed. However, do not place cables until after the foundation pad is installed

Figure 5-9 Typical cable arrangement in the pad cable entrance area

The ONU pedestal (ED7C-851-55 Gr.1), illustrated in Figure 5-10, is delivered separately from the ONU assembly.

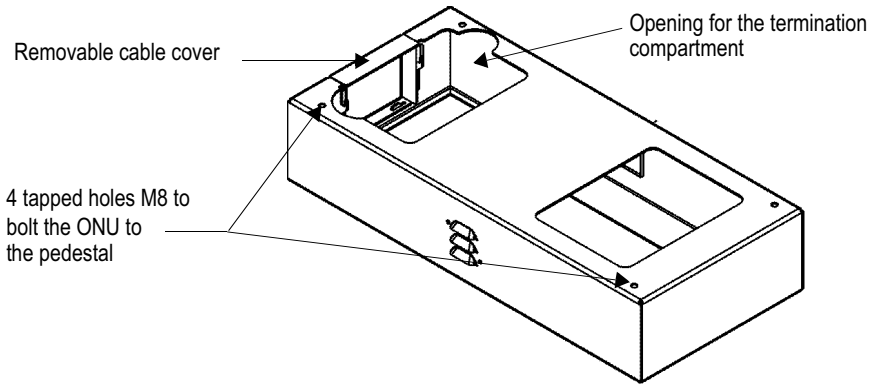

Figure 5-10 ONU Pedestal

Positioning the pedestal

Follow these steps to position and attach the pedestal to the foundation pad:

Step 1. Remove the cable cover from one end of the pedestal.

NOTE:
If cables have not yet been installed, you will not be required to perform some of the following steps relating to cables.

Step 2. If necessary, remove the ONU mounting screws and washers from the anchors on the foundation pad and put them aside.

Step 3. Clean the foundation pad of dirt and debris. Ensure the anchor threads are clean.

Step 4. Place the pedestal on the concrete so that the buried cables route through the termination compartment opening on the left side of the pedestal.

Step 5. Align the pedestal so that the four anchors are in line with the four anchors in the foundation mounting bracket.

Step 6. Insert and tighten the pedestal mounting screws.

Positioning and securing the ONU

Use a crane to position the ONU on the mounted pedestal as follows:

Step 1. Open the termination compartment door of the ONU and latch it into position. Keep the door of the electronics compartment closed.

Step 2. Carefully unlock and remove the cover of the heat exchanger compartment.

WARNING:
After it is unlocked, the heat exchanger cover could drop immediately and cause injury. To prevent injury, hold the cover tightly when unlocking.

Step 3. Refer to Figure 6-2, page 6-5. Using appropriate tools, remove two bolts in the termination compartment and two bolts in the heat exchanger compartment that are securing the ONU to the pallet.

Step 4. Remove the cable entrance cover of the ONU cabinet to enable the ONU housing to slide over the cables.

Step 5. Raise the ONU housing approximately 11¾ in (300 mm), guide it over to the mounted pedestal, and slide it over the cables allowing the cables to be dressed through the cable entrance.

Step 6. Slowly lower the ONU housing and align its mounting holes over the upper mounting holes in the pedestal.

NOTE:
The ONU housing weighs about 156 lbs (71 kg) and can also be moved into position by at least two people.

Step 7. Secure the ONU using the four M8 bolts and washers supplied with the pedestal. Use the same mounting holes that were used to secure the ONU to the pallet.

Step 8. Verify that all doors open and close freely.

Step 9. Remove the B connecting link or clevis from each lifting eye of the ONU. Move slings and boom line away from the ONU.

Step 10. Replace the two cable covers and proceed to Chapter 6 to continue the ONU installation.

Wall Mount

This section describes how to install the wall-mounting bracket and then install the ONU on the bracket. Use the ED7C851-55 Gr.2 wall-mounting kit and an ED7C851-55 Gr.5 adapter plate kit for this purpose.

If you haven't already done so, use the procedures at the beginning of this chapter to mount the Krone cross-connect in the ONU before mounting the ONU on the wall.

Preparing for wall-mounting

The customer is responsible for ensuring that the wall is strong enough to support the ONU. Engineering considerations should include seismic and other loads on the wall, calculated according to local regulations.

Materials required

The following equipment and materials are required to install the ONU on a wall and connect the conduits:

- Wall-mounting kit (ED7C851-55 Gr. 2), including wall-mount bracket, three M8 screws and washers
- Strain relief plate kit (ED7C851-55 Gr. 5), including the adapter plate and 3 strain relief connectors and locknuts
- Eight M8 bolts, washers and anchors.

NOTE:
Use only anchors and bolts suitable for the wall composition and condition. In selecting anchors, consider the ONU's operational weight of 320 lbs (145 kg) when completely equipped with batteries.

- Drill and 10 mm drill bit (depends on the wall condition and anchor size).

NOTE:
The specific installation materials needed to mount the ONU to a wall are site-specific. You may be required to obtain some parts not supplied by Lucent.

Installing the wall-mounting plate on the wall

To mount and secure the wall-mount plate to the wall, proceed as follows:

Step 1. Identify the wall-mounting kit and locate the wall-mount bracket illustrated in Figure 5-11.

Step 2. Ensure that the selected mounting location provides sufficient clearance to the front and sides of the ONU to fully open the door to the electronics compartment.

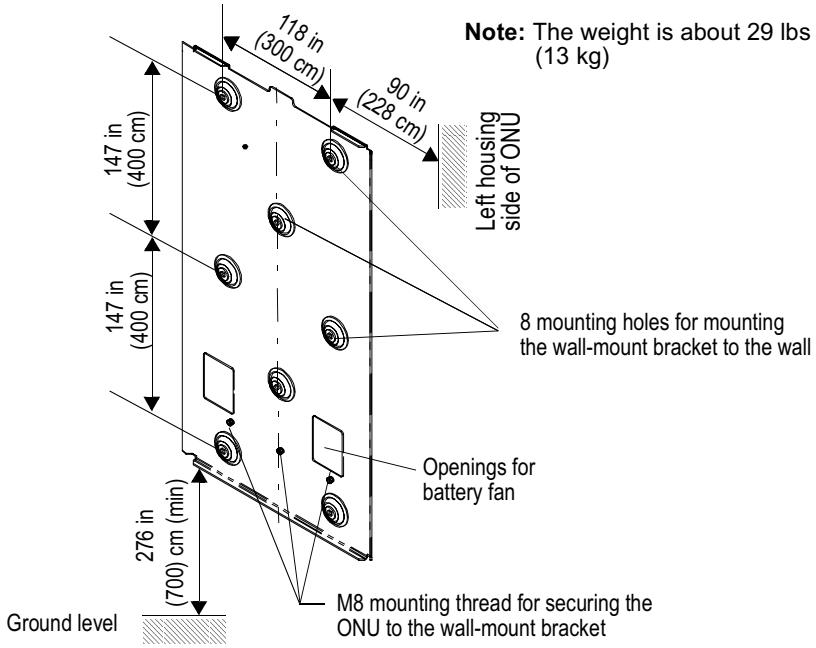
Note: The weight is about 29 lbs (13 kg)
118 in (300 cm)
90 in (228 cm)
Left housing side of ONU
147 in (400 cm)
147 in (400 cm)
8 mounting holes for mounting the wall-mount bracket to the wall
Openings for battery fan
276 in (700) cm (min)
Ground level
M8 mounting thread for securing the ONU to the wall-mount bracket

Figure 5-11 Wall-mount bracket

Step 3. Attach the wall-mounting plate temporarily (for example with one screw in the middle), level the plate on the wall in the desired position and mark the other seven positions for the anchors using the plate as a drilling template.

Step 4. Drill the eight holes necessary to mount the wall-mount bracket.

Step 5. Install the eight anchors.

Step 6. Mount the wall-mount plate on the wall using eight screws and washers. Conform to local mounting regulations and practices.

Installing the ONU on the wall-mount plate

To mount and secure the ONU to the wall-mount plate, proceed as follows.

Step 1. Use a crane to suspend the ONU near the mounting plate and remove the pallet.

NOTE:
The ONU can also be lifted into position by at least two people. However, because the ONU (without batteries or circuit packs) weighs about 156 lbs (71 kg), a crane is recommended.

Step 2. Open the ONU front door and latch the door in position.

Step 3. Locate the three mounting holes in the battery compartment on the rear of the ONU housing and remove the caps.

Step 4. Raise the ONU above the mounting bracket and gently lower the ONU onto the plate. Guide the ONU so that the two mounting tabs on the back of the ONU housing slide over the upper flange of the wall-mount bracket, as illustrated in Figure 5-12.

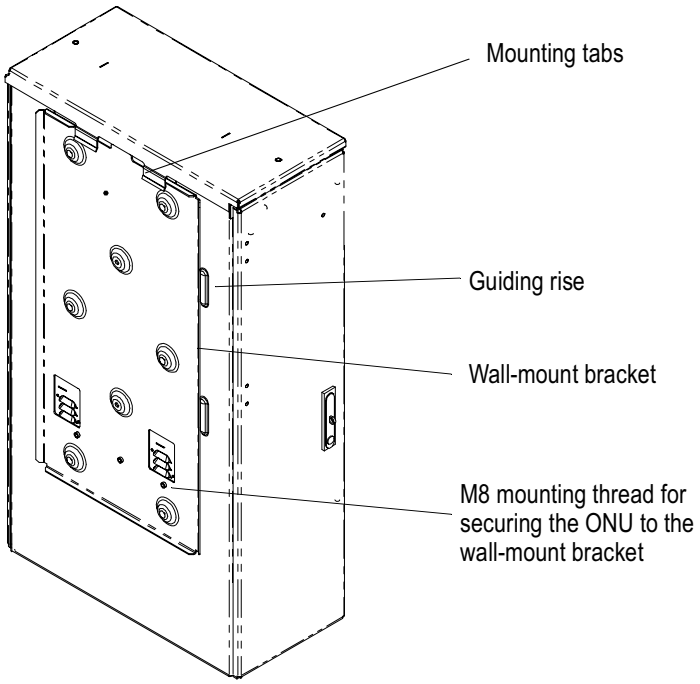

Figure 5-12 Placing the ONU housing on the wall-mount bracket

Step 5. Bring the ONU housing to a vertical position and verify that the ONU housing is secure on the bracket.

Step 6. Check that the front door is open and latched in position.

Step 7. Align the ONU housing so that the mounting holes of the ONU are in line with the thread of the wall-mount bracket. The guiding rise on the back of the ONU will simplify the alignment.

Step 8. Locate the three mounting holes in the back of the battery compartment.

Step 9. From inside the ONU, insert an M8 bolt through each of the three mounting holes.

Step 10. Tighten the three screws that secure the ONU to the bracket.

Step 11. Remove the B connecting link or clevis from each lifting eye of the cabinet. Move slings and boom line away from the cabinet.

Step 12. Proceed to Chapter 6 to continue the installation.

Pole Mount

This section presents one version of how to install a pole-mounting ONU using the pole-mounting kit (ED7C851-55 Gr.3) and strain relief plate kit (ED7C851-55 Gr.5).

NOTE:
The material required for the pole mount is site-specific and depends on the the conditions at the site. You may be required to obtain some parts not supplied by Lucent

NOTE:
Depending on local site and pole configurations, you may be required to use other methods for mounting the ONU on the pole. Also, country-specific regulations may exist for other ways of pole-mounting. In all cases follow local regulations and use appropriate tools and hardware to mount on a pole.

Preparation for pole-mounting

If you haven't already done so, use the procedures at the beginning of this chapter to mount the Krone cross-connect in the ONU before you start mounting the ONU on the pole

The customer is responsible for ensuring that the pole is sufficiently strong to support the ONU. Engineering considerations should include seismic and wind forces and other loads on the pole.

Required Materials

The following equipment and materials are required to install a cabinet on a pole and to connect conduits:

- Pole-mounting kit (ED7C851-55 Gr. 3) with two pole-mount brackets and six M8 screws, nuts and washers
- Wall-mounting kit (ED7C851-55 Gr. 2) with wall-mount bracket, three M8 screws and washers
- Adapter plate kit (ED7C851-55 Gr. 5) with the strain relief plate and three strain relief connectors and locknuts
- Ten long M8 bolts, nuts and washers appropriate to the pole onto which the ONU is to be mounted (bolt length depends on the pole characteristic)

- Drill and 9 mm drill bit (depending on the pole condition)
- Conduit, watertight conduit hubs, and miscellaneous fittings (site dependent)

Other parts may be required depending on site conditions.

Securing the pole-mount bracket to the pole

Use the following procedures to mount he pole-mounting kit on the pole:

Step 1. Locate the wall-mounting kit and the pole-mounting kit.

Step 2. Mount the two pole-mount brackets to the wall-mount bracket as shown in Figure 5-13. Use the six M8 screws and washers delivered with the pole-mounting kit.

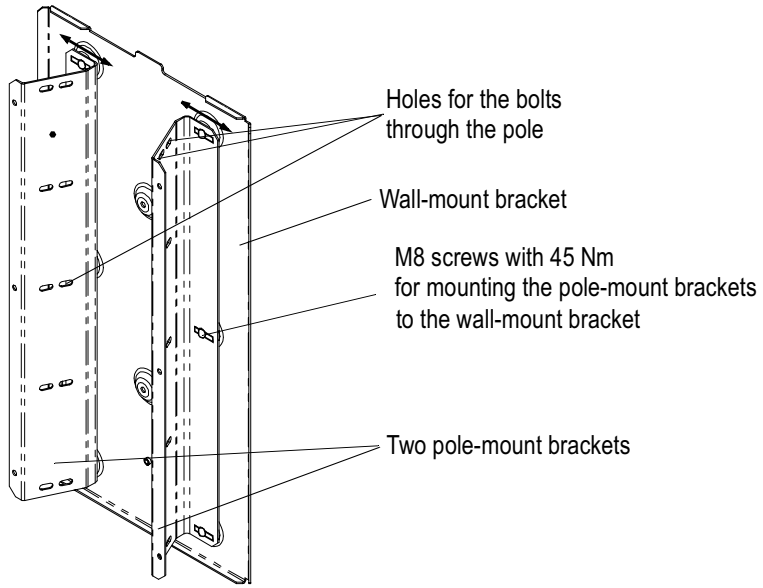
Holes for the bolts through the pole
Wall-mount bracket
M8 screws with 45 Nm for mounting the pole-mount brackets to the wall-mount bracket
Two pole-mount brackets

Figure 5-13 Pole-mount brackets mounted

Step 3. Adjust the pole-mount brackets to the diameter of the pole (see Figure 5-14). The pole-mount brackets can be adjusted using the oblong holes.

Step 4. Tighten the six screws that secure the two pole-mount brackets to the wall-mount bracket.

Step 5. Place the assembled bracket on the pole at the height and orientation desired, and if required, secure the bracket temporarily. The height above ground should be about 27 in (0.7) m to ensure installation and maintenance can be performed without a ladder.

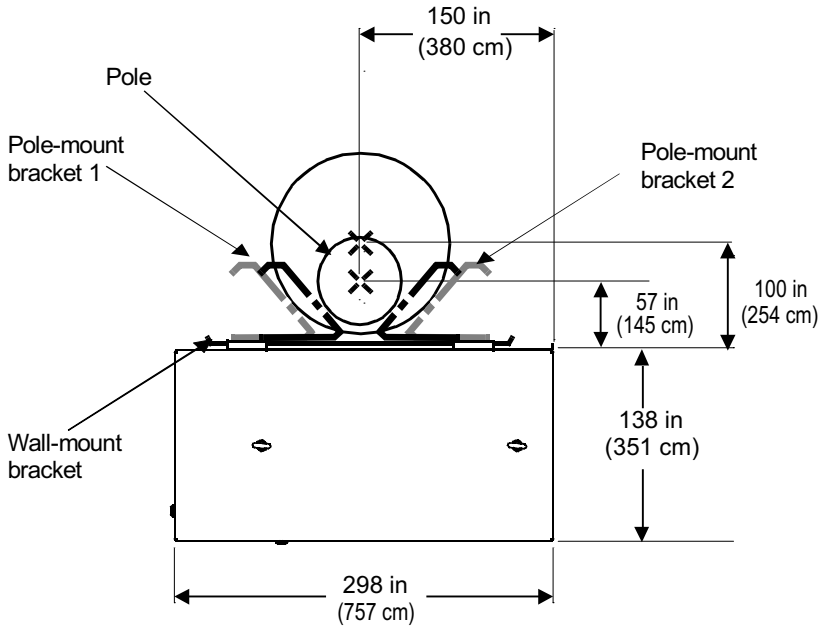

Figure 5-14 Reference dimensions for the ONU housing mounted to the pole

Step 6. Using Figure 5-15, determine where the four bolts will be positioned. It is recommended that each bolt be located in a different row in the bracket to avoid weakening the pole. Also, two bolts should fasten the pole to the left face of the bracket, and the other two bolts should fasten the pole to the front or right face of the bracket.

Comment: Each pole-mount bracket has eight holes for the bolts. The holes are located in four different positions. Two holes in different positions should be used for fastening each bracket.

Step 7. While holding the bracket in place as a guide, bore 9 mm diameter holes for the bolts through the pole.

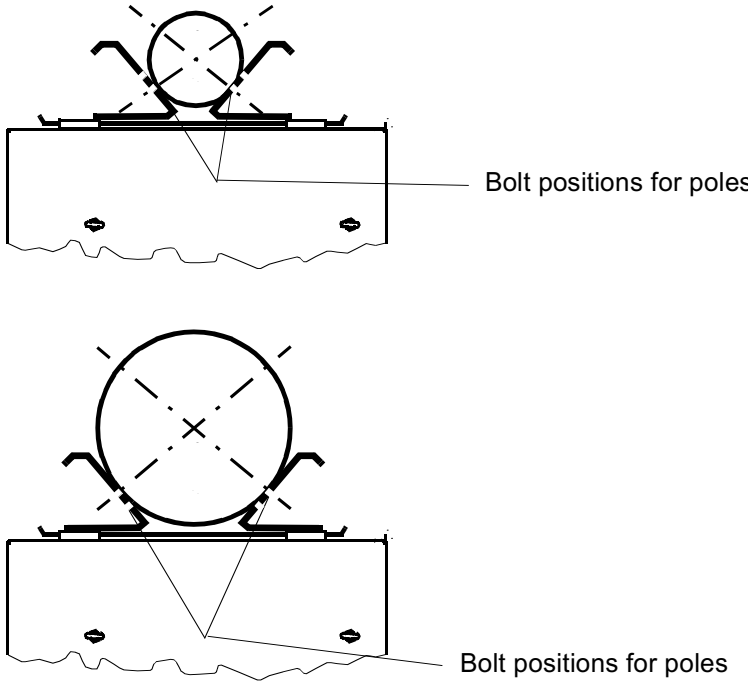

Figure 5-15 Bolt and pole-mount bracket position for different poles

Step 8. Install the four bolts through the bracket and pole with their heads near the ONU housing. Secure with washers and nuts. Verify that the washer on the rear of the pole is of sufficient size (approximately 2 in by 2 in (50 mm by 50 mm)) to prevent the nut from pulling through the pole.

Step 9. Tighten the four bolts that secure the two pole-mount brackets to the pole.

Installing the ONU on the pole

Use the following procedure to secure the ONU housing to the pole-mount bracket.

Step 1. Use a crane to suspend the ONU near the pole.

NOTE:
The ONU can also be lifted into position by at least two people. However, because the ONU (without batteries or circuit packs) weighs about 156 lbs (71 kg), a crane is recommended.

Step 2. Open the front door and latch the door in position.

Step 3. Locate the three mounting holes on the rear of the ONU housing and remove the caps.

Step 4. Raise the ONU above the mounted pole-mount bracket and gently lower the ONU onto the bracket. Guide the ONU so that the two mounting tabs on the back of the ONU housing slide over the upper flange of the wall-mount bracket (see Figure 5-12).

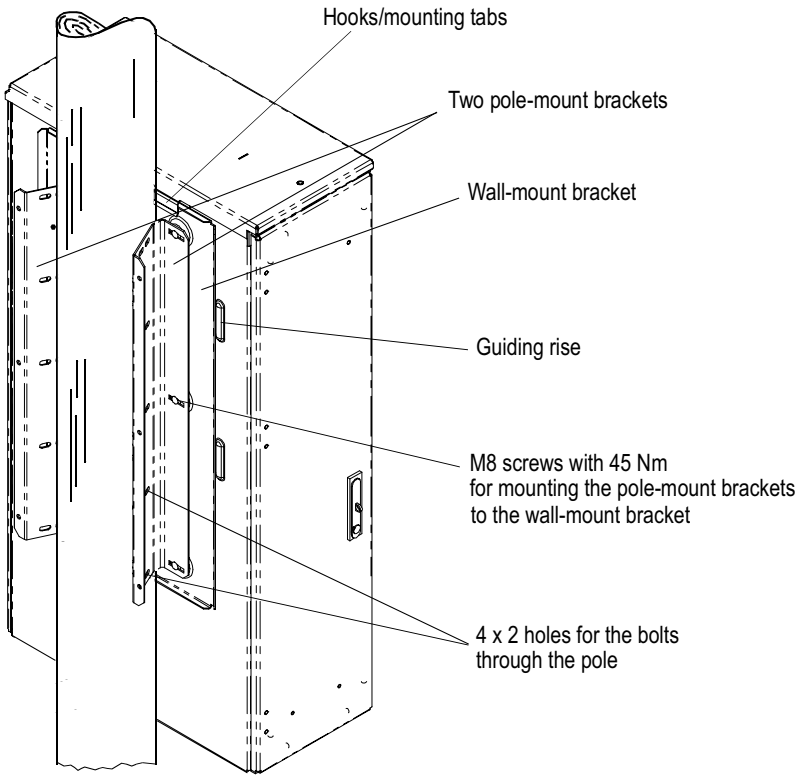

Figure 5-16 Placing the ONU housing onto the pole

Step 5. Bring the ONU housing to a vertical position and verify that the ONU housing is secure on the bracket.

Step 6. Check that the front door is open and latched in position.

Step 7. Align the ONU housing so that the mounting holes of the ONU are in line with the thread of the wall-mount bracket. The guiding rise on the back of the ONU will simplify alignment.

Step 8. Locate the three mounting holes in the back of the battery compartment.

Step 9. For each of the three mounting holes, insert an M8 bolt through the mounting holes from inside the ONU.

Step 10. Tighten the three screws that secure the ONU to the bracket.

Step 11. Remove the B connecting link or clevis from each lifting eye of the cabinet. Move slings and boom line away from the cabinet.

Step 12. Proceed to Chapter 6 to continue the installation.

Installing and Grounding External Cables

6

Overview

This section describes the procedures for installing and grounding the signal and power cables required by the ONU.

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Procedure	6-4
■ **Routing Cables for Wall- and Pole-Mounted ONU**	6-8
Required materials	6-8
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■ **Connecting to the Site Ground**	6-10
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Procedures	6-10
■ **Grounding Subscriber Line Connections**	6-13
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- **Checking the Ground Connections** 6-18
- **Sealing and Caulking the ONU Cables** 6-19

Cabling Overview

This section provides requirements and procedures for grounding and connecting external signal and power cables to the ONU. The grounding kit (ED7C851-55 Gr.4) is packed separately and attached at the bottom of the battery compartment.

Figure 6-1 shows the ONU for pedestal mounting with the external cables installed. The cable arrangements for wall- and pole-mounting are the same as for pedestal mounting, except for the cable boots and the pedestal, which are not used. For these configurations, the strain relief plate kit replaces the pedestal.

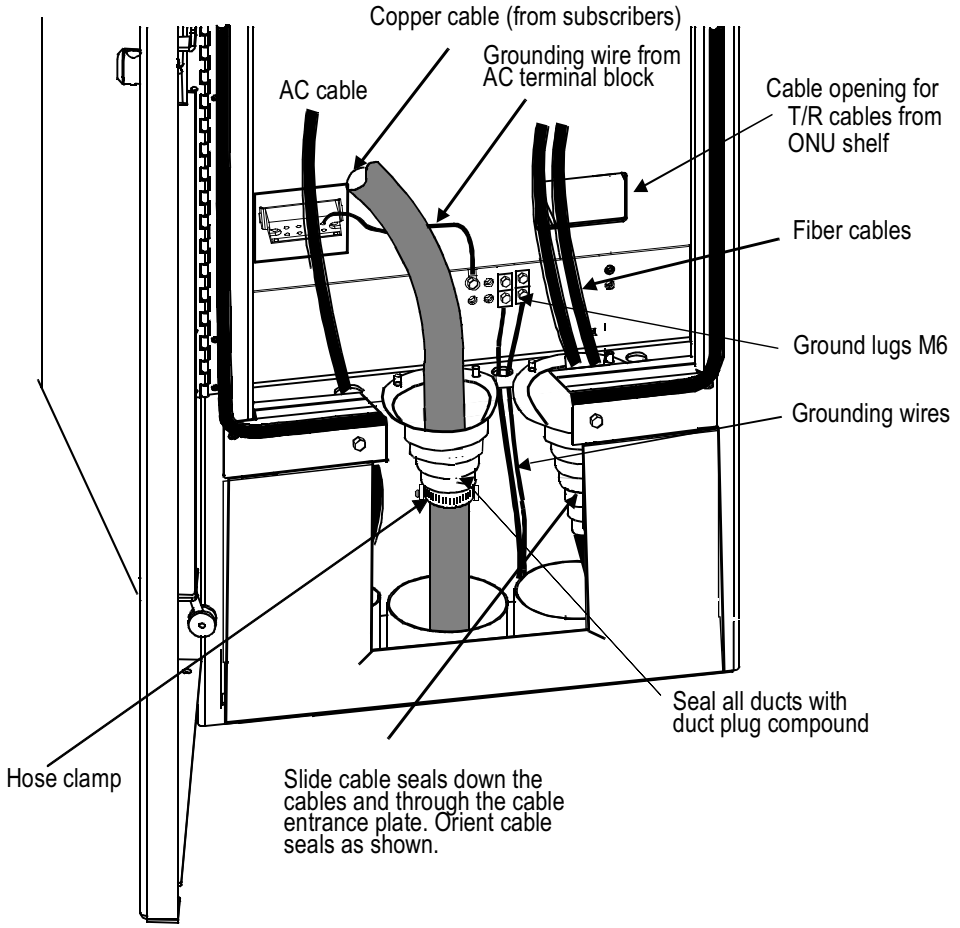
Copper cable (from subscribers)
Grounding wire from AC terminal block
AC cable
Cable opening for T/R cables from ONU shelf
Fiber cables
Ground lugs M6
Grounding wires
Seal all ducts with duct plug compound
Hose clamp
Slide cable seals down the cables and through the cable entrance plate. Orient cable seals as shown.

Figure 6-1 Termination compartment with cables installed (pedestal-mounting shown)

Routing Cables for Pedestal-Mounted ONUs

Required materials

After the ONU housing is mounted on the pedestal, you will need the following materials to insert the cables in the termination compartment of the ONU and install the cable seals:

- Qty 2 rubber cable seal boots
- Qty 6 M6 hex nuts and 3 x cable seal brackets to secure the boots (already mounted at delivery)
- Qty 2 hose clamps
- Ground straps and the other grounding material from the grounding kit
- Qty 3 grommets for the AC cable
- Qty 2 ground wires mounted on the ONU at delivery

NOTE:
The material required is site-specific. Additional parts, which are not mentioned in the Installation Manual, may be required, depending on the site. For example the B/D-clamps for grounding the cable sheaths are not provided.

Procedure

Use the following procedures to insert and secure the cables for the pedestal-mounted ONU.

Step 1. Insert the AC cable through the grommet on the left-hand side of the cable entrance area.

CAUTION:
Do not to pull the cable with excessive force or bend it tighter than its specified bending radius.

Step 2. Insert the two grounding wires through the two grommets at the back of the cable entrance area, shown in Figure 6-2.

Step 3. Loosen the six M4 nuts that fasten the three brackets for the cable seal boots and remove the brackets temporarily. Place the parts in a safe place for reinstalling later.

Step 4. Locate the two rubber cable seal boots. One is for the subscriber cable, the other is for the office fiber cable (or cables). The maximum usable cable diameter is 3.15 in (80 mm).

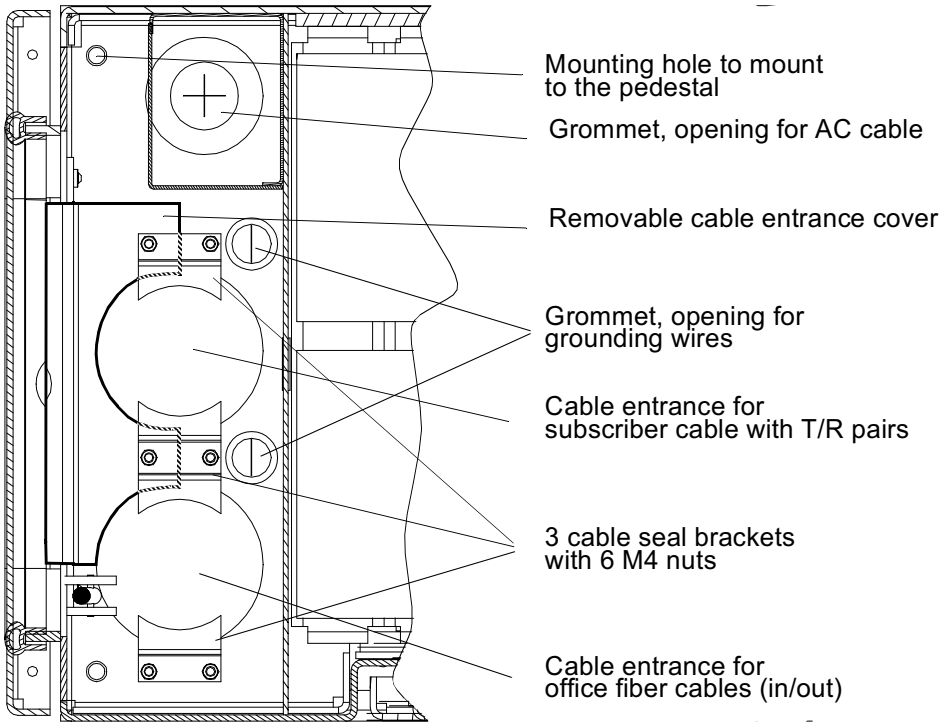
Mounting hole to mount to the pedestal
Grommet, opening for AC cable
Removable cable entrance cover
Grommet, opening for grounding wires
Cable entrance for subscriber cable with T/R pairs
3 cable seal brackets with 6 M4 nuts
Cable entrance for office fiber cables (in/out)

Figure 6-2 Cable entrance area in the termination compartment

Step 5. Install the first cable seal over the subscriber cable as follows:

a. Measure the cable diameter and cut the cable boot to the diameter of the used cable.

b. Slide the hose clamp and then the cable seal over the cable such that the smaller diameter of the seal goes over the cable first and ends up facing down when slid into place. For orientation see Figure 6-1.

c. Position the cable seal to fit into the notch in the cable entrance plate.

d. Tighten the hose clamp.

NOTE:
Microdefects or a broken cable will result when an optical fiber cable is bent with less than the minimum specified bending radius. Microdefects increase the fiber attenuation and reduce long-term stability. Ensure that every bending radius for all fiber cable is at least equal to the specified minimum bend radius.

Step 6. Repeat Step 5. for the one or two (depending on your site requirement) fiber cables. Be careful not to pull the cable with too much force and observe the minimum bending radius.

Step 7. After the cable seals are slid into position, mount the pedestal cable cover.

Step 8. Mount the ONU housing cable entrance cover and secure it with two screws.

Step 9. Check the alignment of the two rubber cable seal boots.

Step 10. Using the three seal brackets and six M4 nuts you removed temporarily in Step 3., secure the seals to the cable entrance plate with the six M4 nuts. If both cable seal boots are not used, secure cable seal(s) over any unused cable port(s).

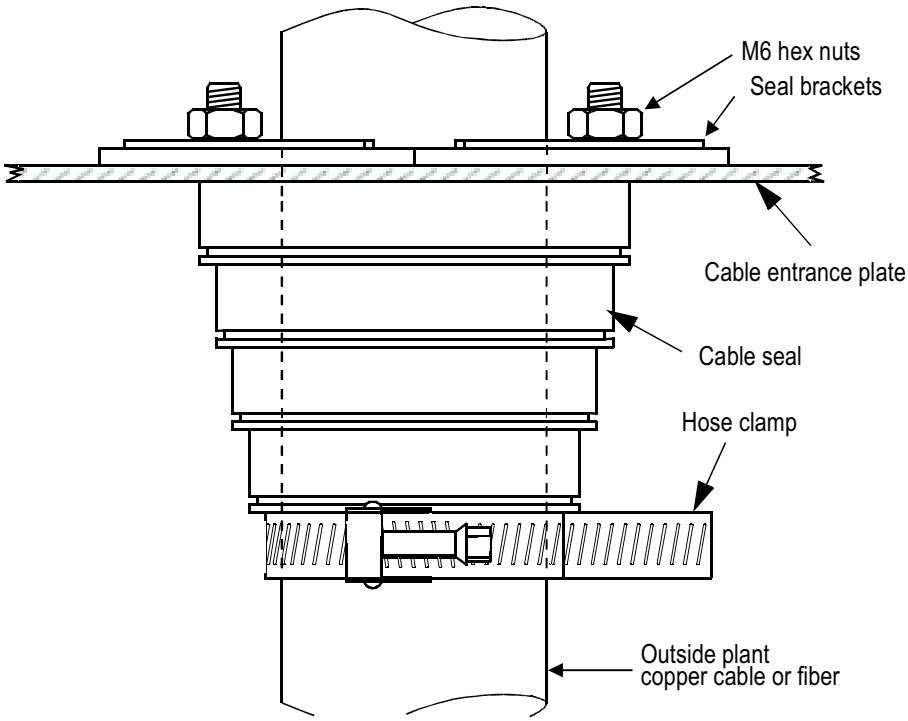

Figure 6-3 Installing the rubber cable seals

Step 11. Use cable ties to temporarily secure the subscriber cable, the fiber cables and the AC cable inside the termination compartment. Be careful not to violate the cable's minimum bend radius requirement.

Step 12. Verify that the grommets for the AC cable and the grounding wires are in place. If required, reinstall the grommets into the cable entrance plate.

NOTE:
Sealing and caulking procedures are provided in Sealing and Caulking the ONU Cables. on page 6-19.

Routing Cables for Wall- and Pole-Mounted ONU

Required materials

After the ONU housing is mounted on a wall or pole, use the strain relief plate kit (ED7C851-55 Gr. 5) to install the cables in the termination compartment of the ONU and seal the cables:

NOTE:
The material required is site-specific depending on the cables used on site. Additional parts not supplied by Lucent Technologies may be required.

Procedure

When you have mounted the ONU and secured it to the wall or the pole, proceed as follows to mount the strain relief plate kit:

Step 1. Open the left door of the termination compartment and latch the door in position.

Step 2. Loosen the six M4 nuts that fasten the three seal brackets for the cable seal boots and remove the brackets. Place the six M4 nuts in a safe place for reinstallation later. The removed brackets are no longer needed for the pole- or wall-mounted ONU.

Step 3. Verify that the grommets for the AC cable and for the grounding wires are in place. Refer to Figure 6-2 for the positions of the grommets and cable entrance holes.

Step 4. Insert the AC power cable through the grommet on the left side of the cable entrance area.

Step 5. Insert the grounding wires through the two grommets at the back of the cable entrance area.

Step 6. Insert the copper subscriber T/R cable through the cable entrance hole in the center subscriber cable.

NOTE:
Microdefects or a broken cable will result when an optical fiber cable is bent with less than the minimum specified bending radius. Microdefects increase the fiber attenuation and reduce long-term stability. Ensure that every bending radius for all fiber cable is at least equal to the specified minimum bend radius.

Step 7. Insert the fiber(s) and carefully pull the fibers, avoiding excessive force. Do not bend the fiber so that the bending radius is less than the minimum specified bending radius.

Step 8. Install the strain relief connectors on the AC cable, the copper cable and the fiber(s).

Step 9. Install the strain relief plate. You must route the AC cable, the copper cable and the fiber(s) through the openings in the plate.

Step 10. Using the six M4 nuts removed in Step 2., fasten the strain relief plate on the six bolts that were used for the seal brackets.

Step 11. Install the sealing fittings on the AC cable, the copper cable and the fiber(s) and fasten to secure the cables.

Step 12. Use cable ties to temporarily secure the subscriber cable, the fiber cables and the AC cable. Be careful not to violate the cable's minimum bending radius requirement.

Step 13. Check that the grommets for the AC cable and the grounding wires are in place. If required reinstall the grommets into the cable entrance plate.

NOTE:
The complete sealing/caulking is described in Sealing and Caulking the ONU Cables on page 6-19.

Connecting to the Site Ground

For pedestal-mounted ONUs, the site grounding system is normally installed beneath the foundation pad before the concrete is poured, as described in Pedestal Mount on page 5-17. At least 1 m of ground wire is required above the pad for both rods A and B (refer to Figure 4 on page 4-2) so that the wires reach the M6 grounding studs inside the ONU. After the pad is constructed and the pedestal and the ONU are mounted on the pad, use the procedures in this section to connect the ONU housing to the site ground wires.

Pole-, and wall-mounted ONUs are grounded in a similar manner, but the above-ground portion of the ground wires must be longer than 1 m to reach the M6 grounding studs. A non-metallic conduit may be required to protect the ground wires when the cabinet is mounted above the ground level.

Required materials

The following materials will be needed to connect the grounding studs inside the ONU to the site grounding wires:

- 2 double-hole lugs (for 16 mm^2/6 AWG wire), which are either part of the grounding kit ED7C851-55 Gr.4 or are already mounted on the grounding studs
- 12 washers and nuts, which are already mounted on the grounding studs

NOTE:
The material required is site-specific and depend on the cables used. Additional parts not supplied by Lucent Technologies may be required.

WARNING:
The installation must have an independent ground connection to an approved ground electrode for outdoor applications. Grounding circuit continuity is vital for safe operation of the ONU.

The independent ground connection should be at least 16 mm^2) or $\leq$ 6 AWG.

If rod-based grounding is required two rods should be used.

Never operate the ONU with a disconnected ground.

Procedures

To ground the ONU housing proceed, as follows.

Step 1. Locate the two customer-provided 16 mm^2/6 AWG solid copper ground wires from ground rod A and B (routed through the rear grommets in the cable entrance area).

NOTE:
Two mechanical double-hole lugs are delivered for connecting a 0.025 in^2 (16 mm^2) round conductor, as typically used with a driven ground rod. If your installation includes a ground conductor with a larger cross section, substitute a suitable lug. For example, if your site ground is a ground ring, the ground conductor is typically 0.054 in^2 (35 mm^2).

Step 2. Cut the ground wires to an appropriate length to reach the M6 grounding studs. Remove the sheath, as required, and crimp the double-hole lugs.

Step 3. Connect the ground wires to the M6 grounding studs on the ONU ground bus. Fasten the M6 double-hole cable lugs at the grounding studs with the external toothed lock washer and the M6 hexagonal nut; see Figure 6-4, page 6-12 for mounting.

Step 4. Connect a ground wire 16 mm^2/6 AWG).

Step 5. from the M6 grounding stud to the ground terminal in the AC termination box.

Step 6. If the Krone cross-connect is already installed, connect the two grounding wires coming from the cross-connect rods to an M6 ground stud.

NOTE:
The conductive members of the cabinet structure are made of aluminum which has been chemically oxidized to provide a conductive finish. Installer ground connections should be made using only copper or aluminum lugs that are silver- or tin-plated. Unplated copper lugs are not recommended.

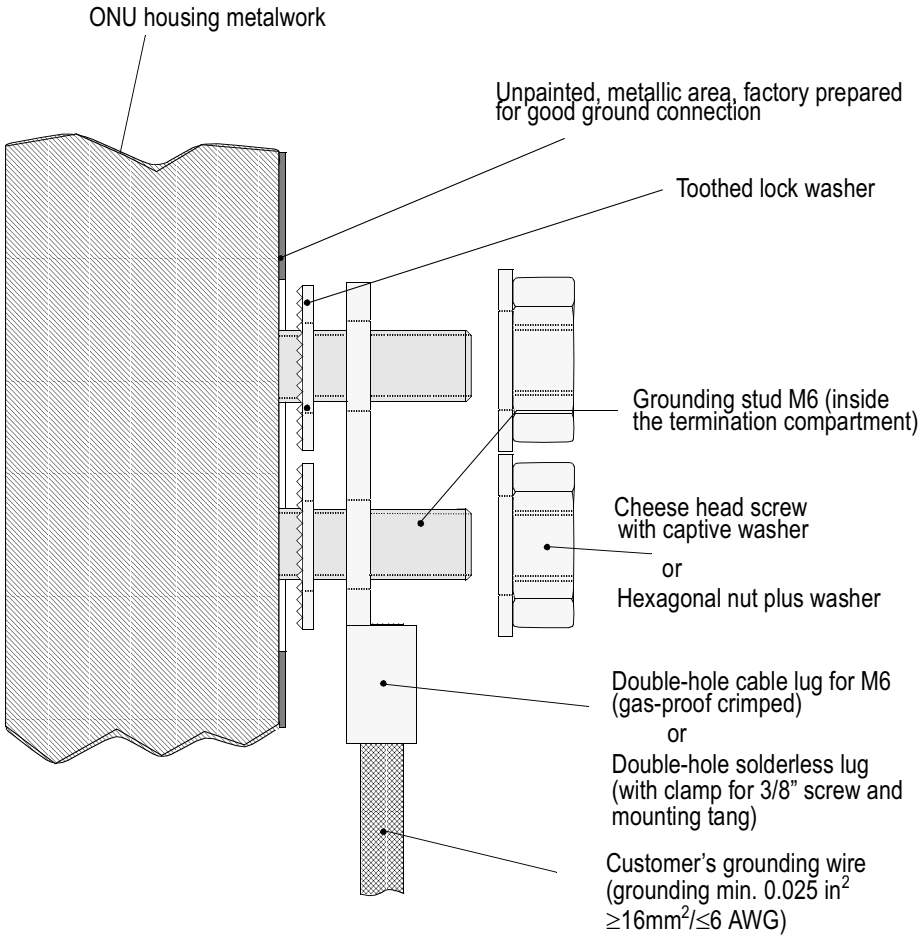
ONU housing metalwork
Unpainted, metallic area, factory prepared for good ground connection
Toothed lock washer
Grounding stud M6 (inside the termination compartment)
Cheese head screw with captive washer
or
Hexagonal nut plus washer
Double-hole cable lug for M6 (gas-proof crimped)
or
Double-hole solderless lug (with clamp for 3/8" screw and mounting tang)
Customer's grounding wire (grounding min. 0.025 in^2 ≥16mm^2/≤6 AWG)
Grounding: to approved bonding ring conductor or to the next approved main grounding terminal
Potential equalization: to the neighboring ONUs only if required

Figure 6-4 Set of parts for grounding the ONU

NOTE:
In all cases, comply with local grounding practices. The cross-connect must have primary protection if the subscribers are located outside the building or the cabling is very long. In all cases, for protection follow local regulations.

Grounding Subscriber Line Connections

Copper cable

This section describes how to make the ground connections for the subscriber copper cables in the ONU. If buried cables are used, test the cable sheaths for voltages before connecting the cables to the ONU.

The materials required are site-specific. Additional parts may be necessary, depending on site conditions and the specific copper cable(s) used. For example the B/D-bond clamps for grounding the cable sheaths are not supplied.

To ground the copper cable using D-bond clamps proceed as follows:

Step 1. Check that the two (A and B) grounding wires from the site ground are connected to the M6 grounding studs of the ONU.

Step 2. Using a (customer furnished) B/D-bond clamp and a 16 mm^2/ 6 AWG) stranded copper bond strap (from the grounding kit ED7C851-55 Gr.4), bond each cable sheath as shown in Figure 6-5.

Step 3. Attach the bond strap to the M6 grounding studs inside the termination compartment.

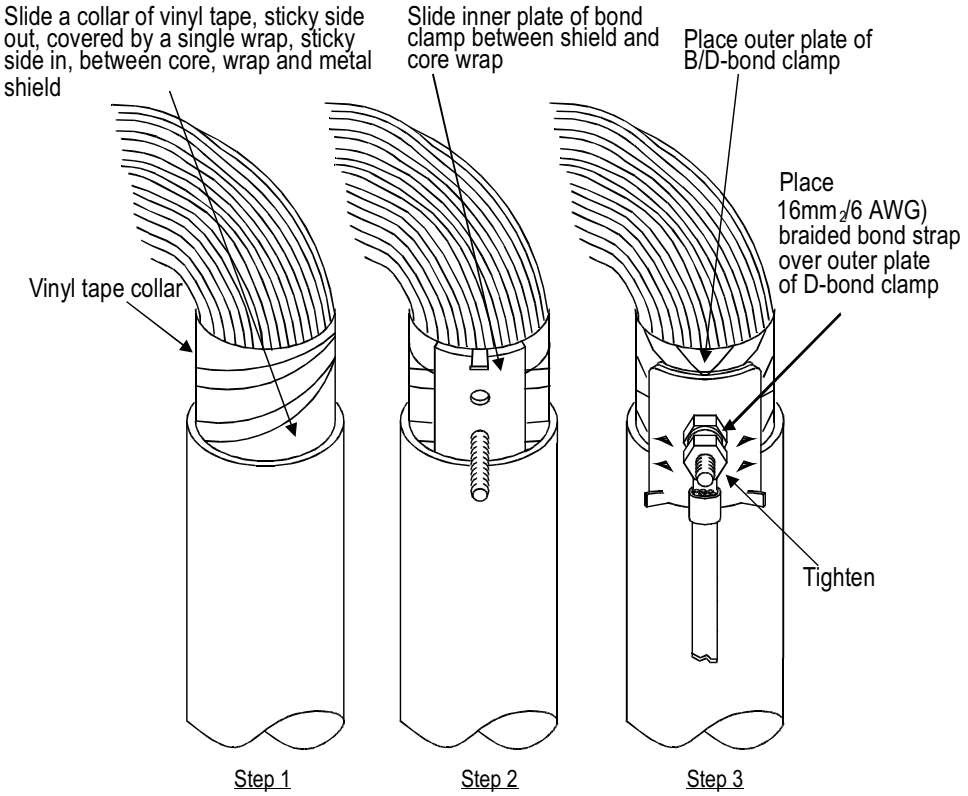
Slide a collar of vinyl tape, sticky side out, covered by a single wrap, sticky side in, between core, wrap and metal shield
Slide inner plate of bond clamp between shield and core wrap
Place outer plate of B/D-bond clamp
Place 16mm2/6 AWG) braided bond strap over outer plate of D-bond clamp
Vinyl tape collar
Tighten
Step 1
Step 2
Step 3

Figure 6-5 Bonding the cable sheath

Step 4. If required, remove the cable sheath starting approximately 2 inches (50 mm) above the cable seal. Secure the cable ends with vinyl tape.

Step 5. Install binder group identification ties on each 16-pair group and remove the unit binders. The binder group identification depends on the cables used.

Step 6. If the cables will be connected to the cross-connect at a later date, store the cables in the termination compartment and secure with cable ties.

Fiber Cable

This section describes how to make the ground connections for the ONU fiber cable. If buried cables are used, test the cable sheath for voltages before connecting the cable to the ONU.

For grounding a single fiber cable with a metallic sheath, the grounding kit ED7C851-55 Gr.4 contains two cable shield connectors for fiber cables (EM3956-8-3SP.25RG from Electric Motion Co.), illustrated in Figure 6-6.

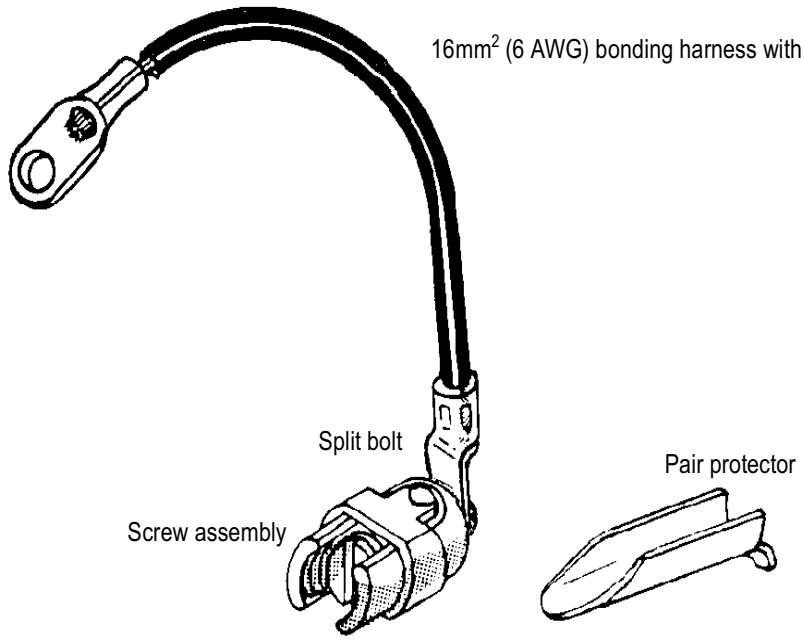

Figure 6-6 Grounding kit with cable shield connectors for fiber cables

To grounding a single fiber with the fiber cable shield connector, proceed as follows:

Step 1. Cut the fiber with excess length to reach the fiber splice organizer after the fiber winds two turns around the spool.

Step 2. Remove about 2¾" (7 cm) of the sheath in the middle of the fiber about 4 inches (10 cm) below the position of the fiber clamps by cutting along the top, both sides, and bottom (four cuts).

Step 3. Clean the inner shield by scraping the coating from the shield. If required, use fine emery cloth for cleaning until the shield coating is removed.

Step 4. Place the pair protector on the bottom of the shield.

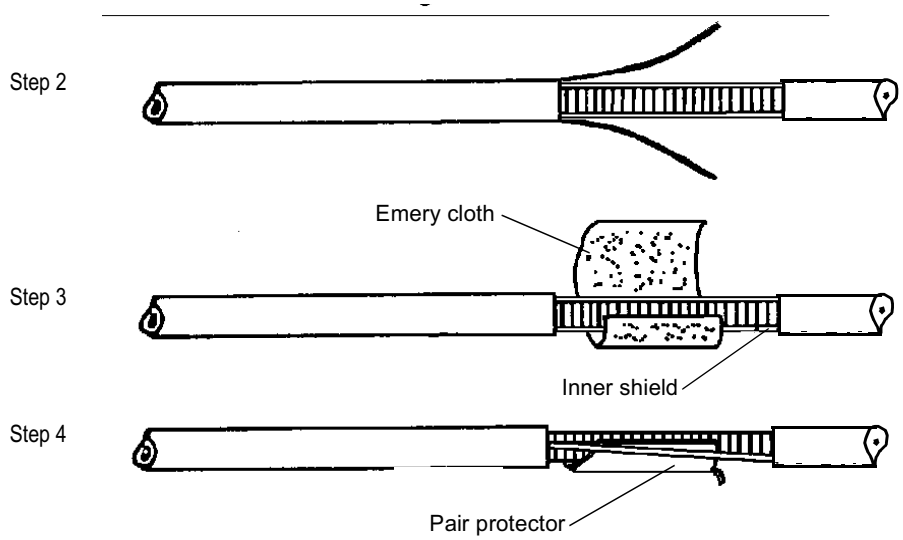

Figure 6-7 Removal of the sheath and placing the pair protector

Step 5. Place the split bolt around the pair protector, allowing both strength members to be positioned at the bottom corners.

Step 6. Insert the screw assembly into split bolt and tighten until the pair protector, strength members and the shield are secure.

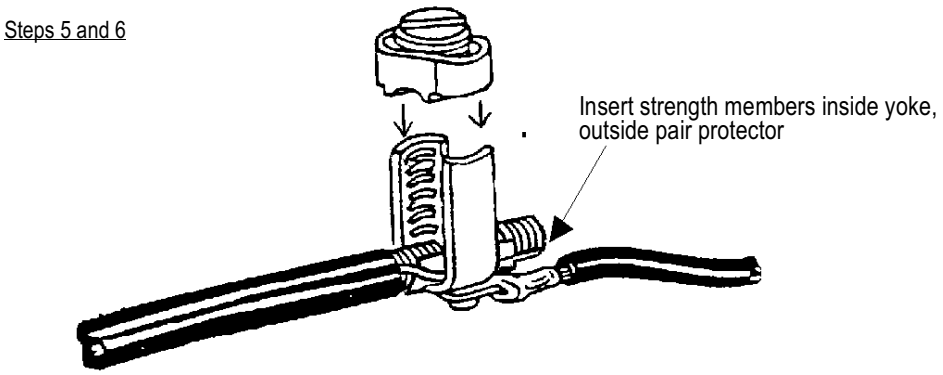

Figure 6-8 Mounting the fiber in the split bolt

Step 7. Fix the fibers into the fiber clamps directly below the fiber splice organizer.

Step 8. Connect the bonding harness to one of the M6 grounding studs.

Grounding the AC Power Cable

If the AC power cable is shielded, connect the sheath to one of the M6 grounding studs.

If buried cables are used, test the cable sheaths for voltages before connecting the AC power cable to the ONU.

NOTE:
The material required is site-specific and depend on site conditions and the AC cable used. Always use the appropriate grounding material designated for the AC cable used. Follow local practices.

Checking the Ground Connections

After grounding, the connection from the framework to the bonding ring conductor must be checked/measured according to local regulations.

Proceed as follows:

Step 1. Verify that no *AnyMedia* packs are inserted in the ONU shelf.

Step 2. The connection from the framework to the bonding ring conductor must be measured according to local regulations.

Step 3. Ensure the electrical continuity of the connections between:

a. FRMGND (framework)

b. approved ground electrode/terminal

c. framework of adjacent ONU housings

d. cable sheaths.

NOTE:
Under normal operational conditions, voltages above about 1 V are not allowed between the ground wire and the grounding points mentioned above.

Step 4. If required measure the grounding resistance according to local regulations.

Sealing and Caulking the ONU Cables

This section details how to seal the cables in the cable entrance area.

NOTE:
The caulking material required is site-specific and must be provided by the customer. Always use the appropriate caulking material suitable for the environmental conditions and cables used. Follow local practices and conform with national regulations.

Figure 6-9 illustrates the ONU with all external cables installed and grounded.

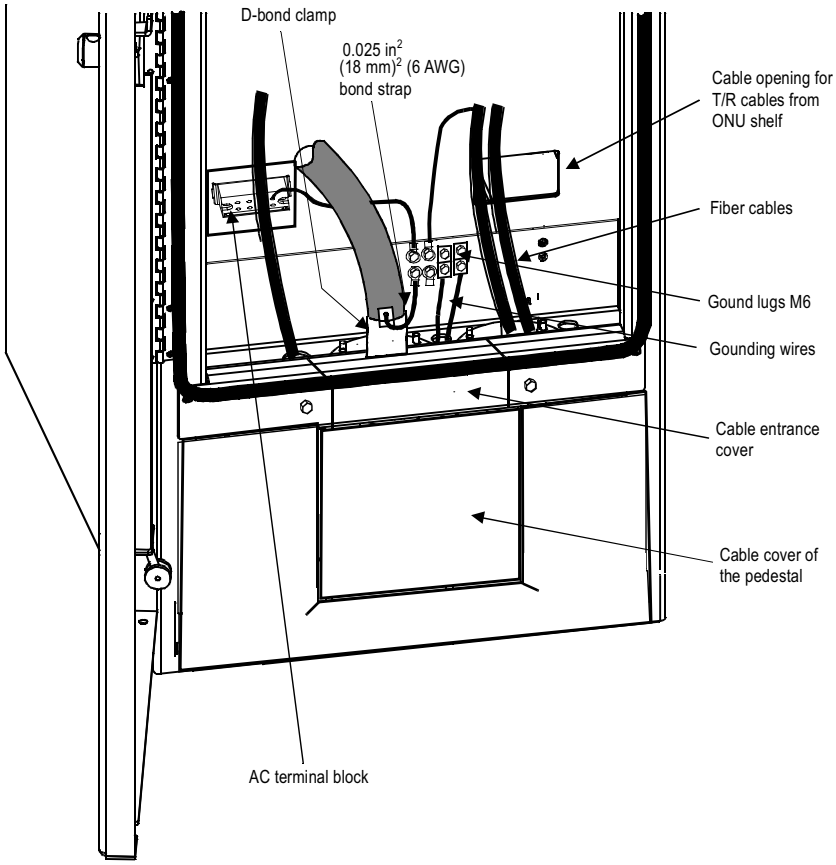

Figure 6-9 Cables inserted and grounded

Seal the ONU cable entrance using the following procedures.

Step 1. Verify that all cables are correctly inserted through the bottom of the cable entrance area and that all grommets and cable seals are

correctly positioned/secured. Figure 6-10 illustrates the cable entrance ports

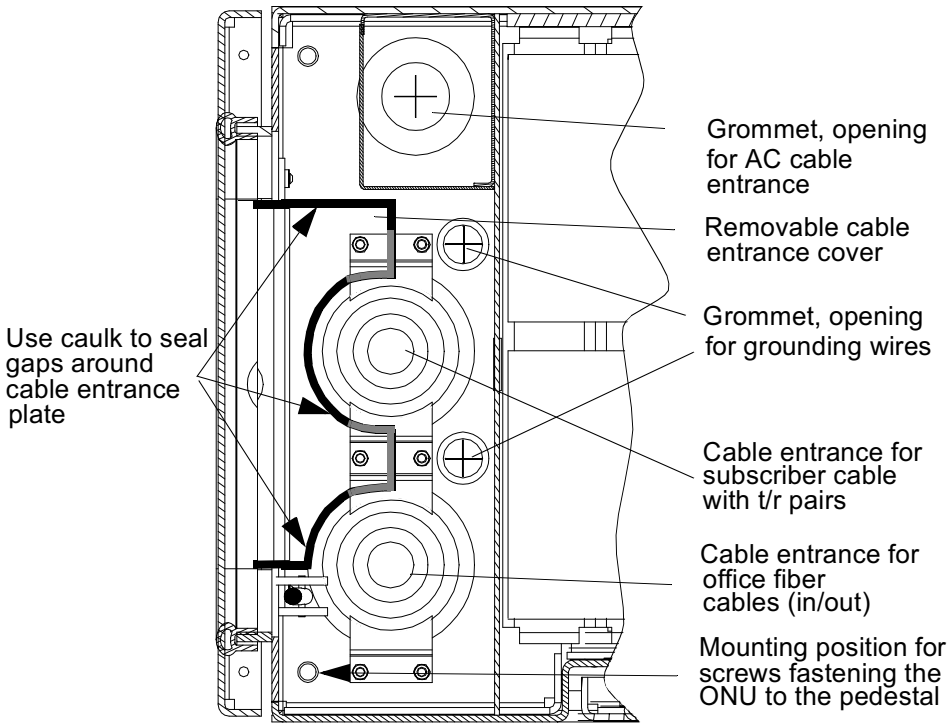
Grommet, opening for AC cable entrance
Removable cable entrance cover
Grommet, opening for grounding wires
Use caulk to seal gaps around cable entrance plate
Cable entrance for subscriber cable with t/r pairs
Cable entrance for office fiber cables (in/out)
Mounting position for screws fastening the ONU to the pedestal

Figure 6-10 Cable entrance ports (shown with seals and grommets installed)

Step 2. Caulk any gaps between the cables and the cable seals. This is particularly important if more than one cable is installed in a single cable seal.

Step 3. Seal around the entire cable entrance plate and seal all grommets using the appropriate caulking material according to local regulations (suitable for the environmental conditions and for the cables used) For example, silicone sealant or B caulking compound may be used. Ensure that the seals are watertight.

Step 4. Caulk around the top of the cable ducts with duct plug compound to seal clearances between the cables and ducts. Also, seal all duct openings without cables (see Figure 6-1).

NOTE:
Gaps will allow moisture, insects, and other contaminants to enter the cabinet, causing condensation and equipment damage. Ensure that all gaps at the bottom of the termination compartment are completely sealed.

Connecting the Signal Lines

7

Overview

This chapter provides the procedures for installing the ONU copper and fiber signal cables. Personnel experienced with the ONU may skip to 7-13.

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Signal Cabling and Wiring Overview

ONU cables are classified as:

- Internal cables/wiring that connect the assemblies within the ONU
- External cables that connect to facilities outside the ONU housing, such as the customer's equipment and the AC power supply.

Internal cables

The ONU is delivered with all internal cables in place, many of which are pre-connected. You will be required, however, to complete the connections for the:

Base Housing Configuration

The ONU is delivered in the base housing configuration (ED7C851-50 Gr.x) without the pre-installed Krone cross-connect, and you must mount the cross-connect. Mounting instructions are provided in Mounting and Installing the Optional Cross-Connect on page 5-3. Figure 5-2, page 5-5 shows you how to route the T/R cables and the optional TAP-B and TAP100 cables to the Krone cross-connect for combined POTS and xDSL applications.

Normally the eight T/R-cables and the TAP-B cable from the ONU shelf are pre-installed at delivery and are fixed in the cross-connect area. Instructions for connecting the T/R cables to the feeder side of the internal Krone cross-connect are provided in "Connecting T/R-cables for the base housing configuration" on page 5-9.

TAP cross wiring

If the metallic test feature is supported, make the following connections for the metallic test feature:

- TAP-B
- TAP100 AP

See 'Interconnecting the test application paths (option)" on page 7-16. The cross-connect assignment for these interconnections is provided in Table 7-2., page 7-18.

External cable(s) from the subscribers

Connect the customer's equipment to the distribution side of the internal cross-connect according to the work order or the instructions of the network provider. See "Installing the customer copper cables" on page 7-18.

NOTE:
On the distribution side, normal 10-pair LSA PLUS 2/10 disconnection blocks are used, which must be cabled from the top connecting points to the customer's copper cabling so that the lower connecting points of the block can be used for the crosswiring to the feeder side.

Cross connecting the feeder and distribution sides

The feeder side and the distribution side of the cross-connect must be crosswired with jumper wires according to the work order or the instructions of the network provider. Procedures for crosswiring are provided in "Installing the cross-connect jumper wires" on page 7-20.

Primary protection

The distribution side must be primary protected with protection magazines such as those equipped with 3-point gas-filled arrestors, for example. For the position of the protector magazines, see Figure 7-1 on page 7-6.

ONU Cable Reference

The following drawings of the ONU internal and external cables illustrate the cabling and wiring procedures described in this chapter:

- Figure 7-1 illustrates the cables in the ONU termination compartment. The external cables shown entering the ONU termination compartment through the cable entrance at the bottom are the cables that you connect to the ONU during the installation process.
- Figure 7-2 illustrates the cable arrangement for the ONU shelf.
- Figure 7-3 is a schematic diagram of the cabling located inside the ONU electronics compartment.
- Figure 7-4 illustrates the physical connections of the cables inside the electronics compartment.
- Figure 7-5 illustrates the physical connections of the cables inside the termination compartment.

Table 7-1 summarizes all the ONU cable connections.

Cable routing

Figure 7-1 and Figure 7-2 illustrate the cable routing in the termination and electronics compartments, respectively.

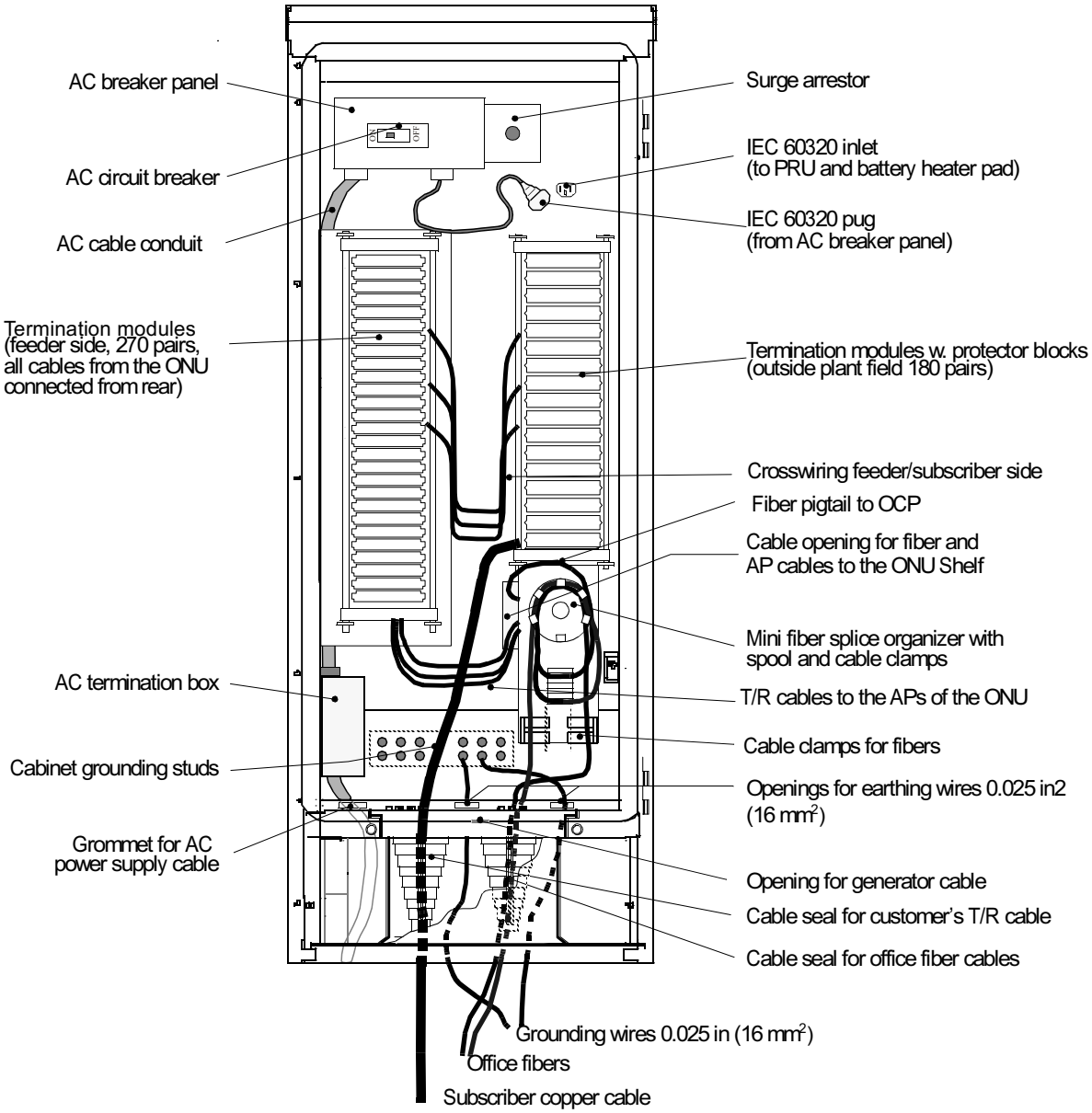

AC breaker panel
AC circuit breaker
AC cable conduit
Termination modules (feeder side, 270 pairs, all cables from the ONU connected from rear)
AC termination box
Cabinet grounding studs
Grommet for AC power supply cable
Surge arrestor
IEC 60320 inlet (to PRU and battery heater pad)
IEC 60320 pug (from AC breaker panel)
Termination modules w. protector blocks (outside plant field 180 pairs)
Crosswiring feeder/subscriber side
Fiber pigtail to OCP
Cable opening for fiber and AP cables to the ONU Shelf
Mini fiber splice organizer with spool and cable clamps
T/R cables to the APs of the ONU
Cable clamps for fibers
Openings for earthing wires 0.025 in2 (16 mm2)
Opening for generator cable
Cable seal for customer's T/R cable
Cable seal for office fiber cables
Grounding wires 0.025 in (16 mm2)
Office fibers
Subscriber copper cable

Figure 7-1 Cable routing inside the termination compartment (cross-connect for POTS and xDSL shown)

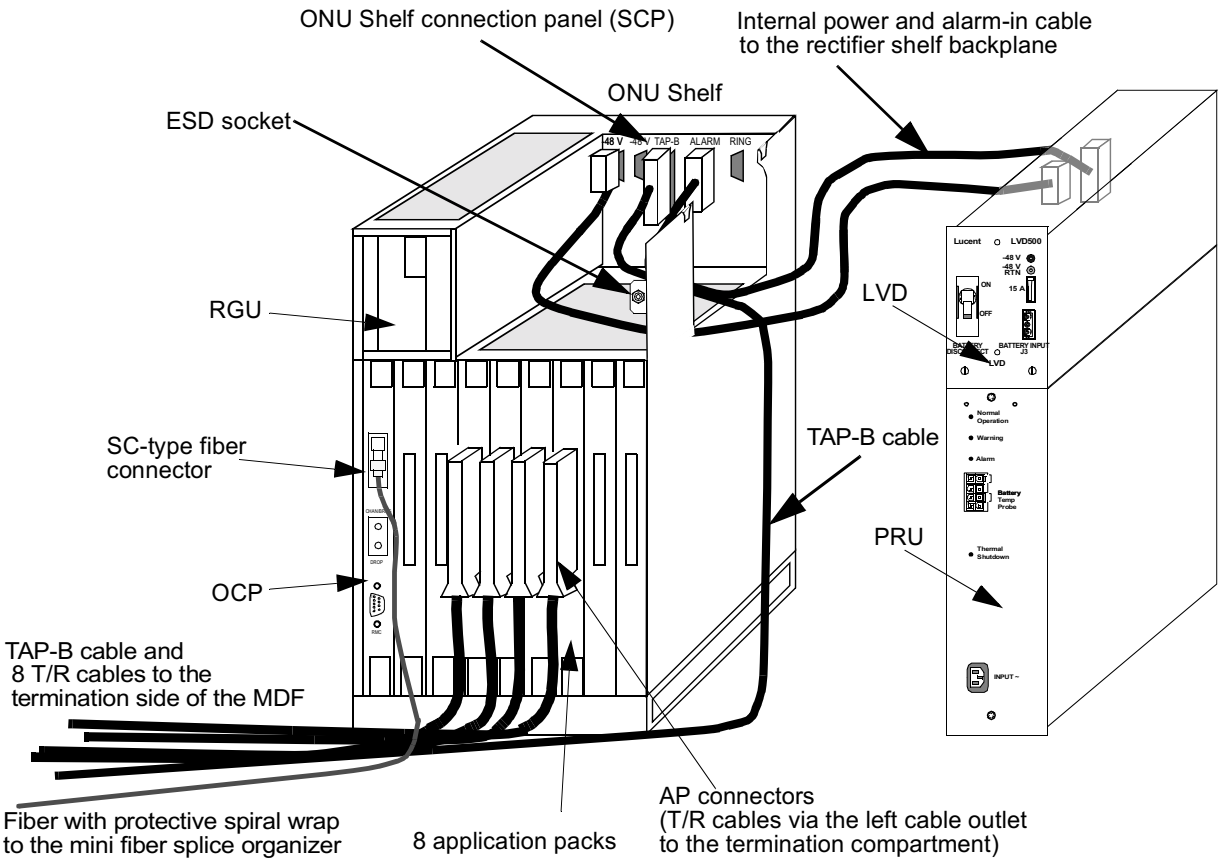


Figure 7-2 ONU shelf cabling arrangement

Cable diagrams

Figure 7-3 is a schematic of the ONU cabling in the electronics compartment. Figure 7-4 illustrates the connectors and cable positions within the ONU electronics compartment. Figure 7-5 shows the connectors and cable positions within the ONU termination compartment.

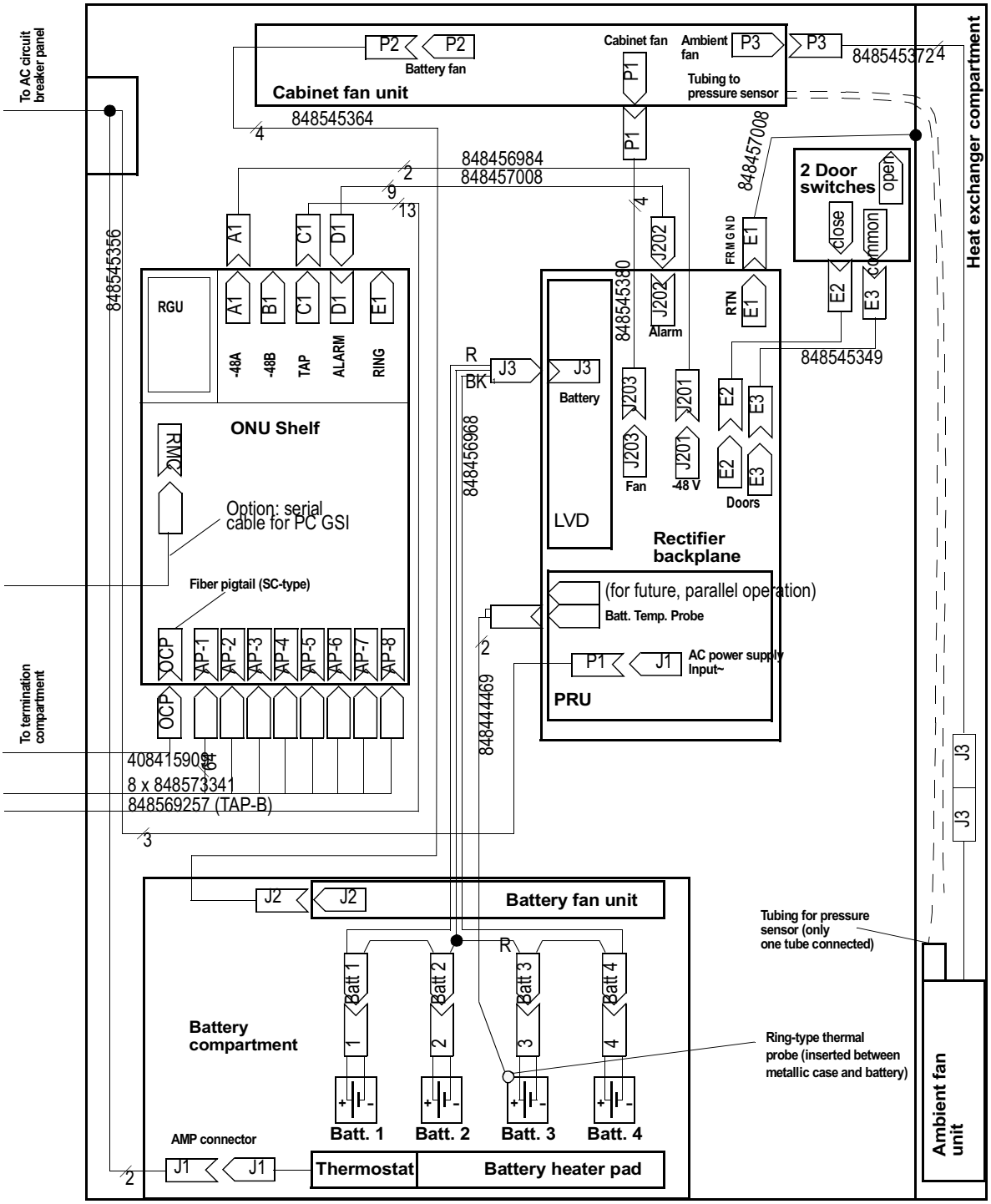


Figure 7-3 Internal ONU cabling inside the electronics compartment

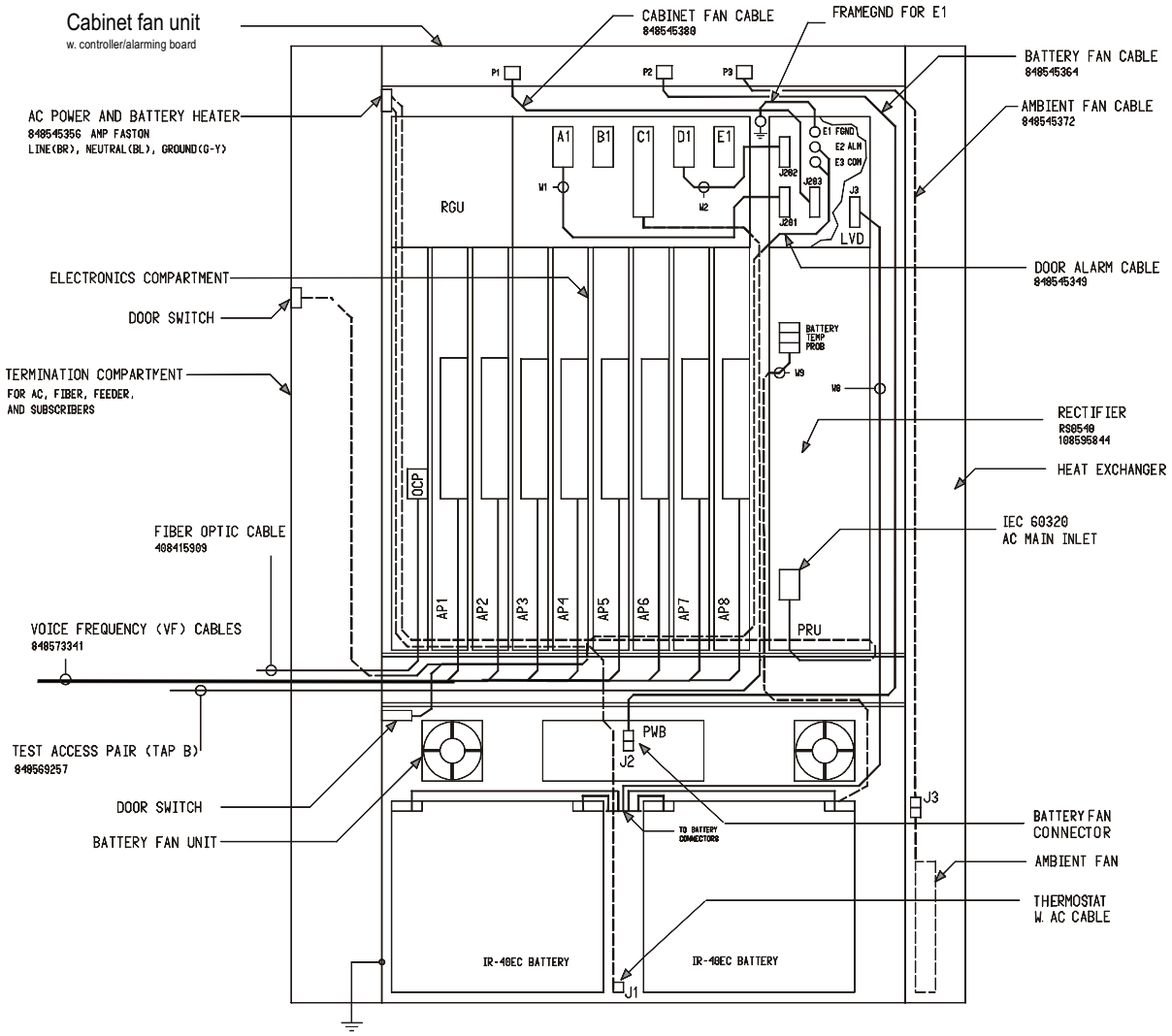


Figure 7-4 Connector and cable positions of the pre-installed cabling inside the electronics compartment

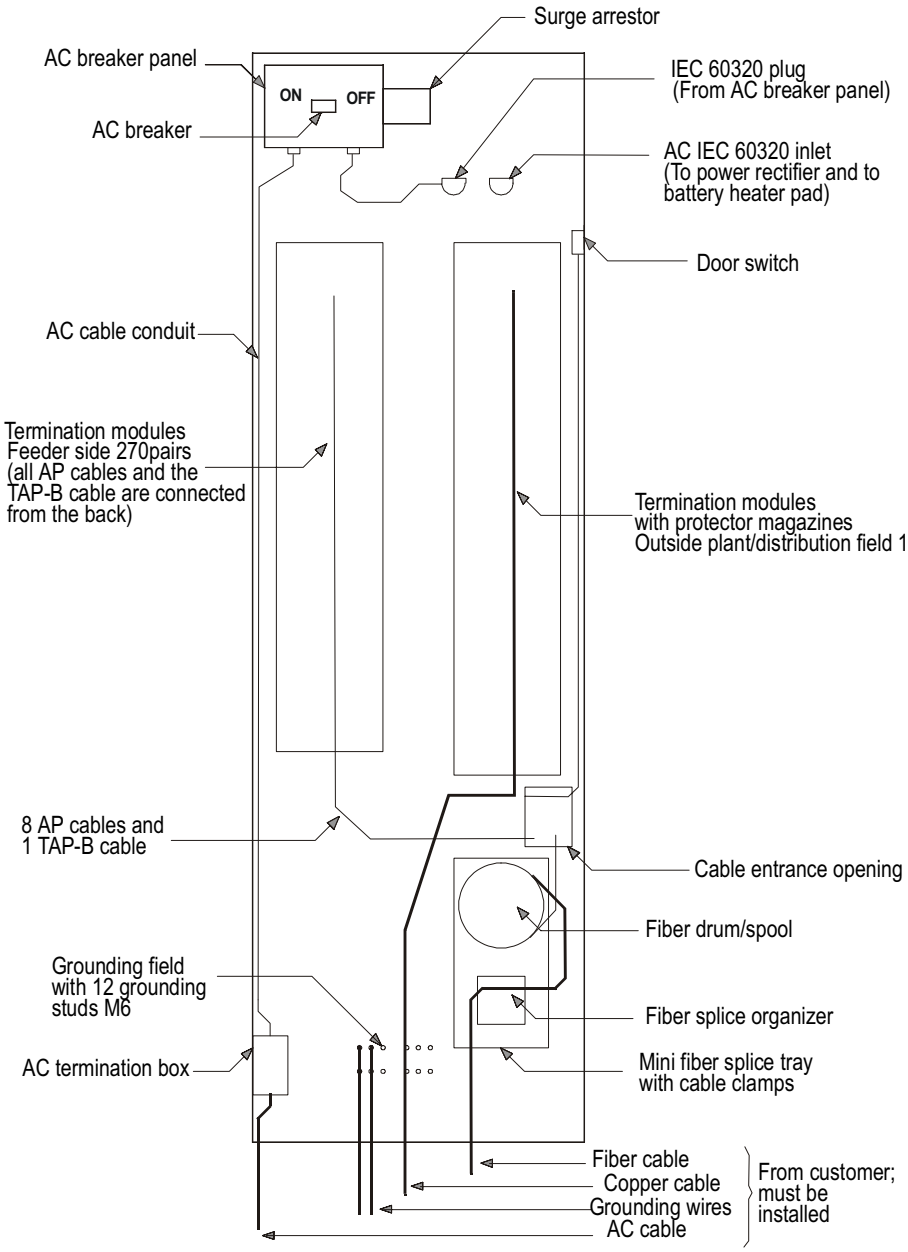


Figure 7-5 Cable positions of the pre-installed (except as noted) cabling inside the termination compartment

Cable connection table Table 7-1lists all the ONU cable connections.

Table 7-1. ONU Cable connections

Destination 1	Destination 2	Equipment Code or Comcode	Cable used for:
A. Internal cables, connected at factory			
Rectifier shelf backplane: male J201	ONU shelf: male A1	848456984	Power cable for internal -48 V DC
Rectifier shelf backplane: female J202	ONU shelf: female D1	848457008	Alarm cable
Rectifier shelf backplane: male J203	Cabinet fan unit: male P1	848545380	Cabinet fan cable
Ambient fan unit inside the heat exchanger: male J3	Cabinet fan unit: female P3	848545372	Ambient fan cable
Rectifier shelf backplane: E2, E3 (plug)	Door switches (the two lower terminals E2, E3 of the switches)	848545349	Intrusion door switch Y-cable
Rectifier shelf backplane: E1 (plug)	Inside ONU housing: upper M6 grounding stud	848545349	Interconnection wire (FRMGND - 48VRTN)
IEC 60320 plug, coming from the AC breaker panel	IEC 60320 inlet near AC breaker panel	part of the Ac breaker panel	AC power supply cord for IEC-60320 inlet, approx 1 ft (0.3 m)
B. Internal cables, delivered and installed, which have to be connected during installation to destination 2			
LVD: female J3	Battery dangler cable connectors (female) for batteries 1 to 4	848456968	Battery set cable [a]
Rectifier unit: male battery temp. probe connector	Ring-type thermal probe inserted between the metallic case and plastic housing of battery 3	848444469	Thermal probe
Blade terminals of the panel-mount IEC 60320 inlet near the AC breaker panel[b]	Rectifier: male IEC 320 AC power supply inlet “Input”	848545356	AC power supply cord[c]
	Battery heater pad, 3-pin AMP connector J1		AC cable for battery heater (option)
Cabinet fan unit, female conn. P2	Battery fan unit, male conn. J2	848545364	Fan cable for the optional battery fan (option)
ONU shelf: AP-1 to AP-8 (also used for the optional TAP100)	Cross-connect, feeder side	848573341	T/R-cable, 10 ft (≈ 3 m)
ONU shelf: male conn. C1	Cross-connect, feeder side	848569257	TAP-B cable for ONU shelf 10 ft (≈ 3 m); option

Table 7-1. ONU Cable connections (Continued)

Destination 1	Destination 2	Equipment Code or Comcode	Cable used for:
C. External cable, prefabricated, must be routed and connected in case of AC power loss			
Panel-mount IEC 60320 inlet (on the right of the AC breaker panel inside the ONU	Output terminals of an external AC generator	848506820	Extension power cord for the AC generator,10 ft (≈ 3 m); option
D. Fiber cable, prefabricated, which must be routed and connected during installation[d]			
ONU shelf: OCP, SC connector	Fiber splice organizer: splice to the office fiber cable	408415909	Fiber pigtail with SC connector, 3 ft (≈ 1 m)
E. External cable, customer-made (not delivered), which must be assembled, routed and connected during installation			
Customers' equipment	Subscriber side of the internal cross-connect	Customer; site-dependent	Connecting to the customers' equipment
M6 earthing studs in the termination compartment	Earth: approved ground terminal/ green wire or to the two earthing rods	External (double-hole cable lug for 0.024 in^2 (16 mm^2) / M6 is required)	Earthing and grounding

a. Not connected, batteries and LVD will be mounted during installation.

b. Not connected, the rectifier will be mounted during installation. Connection to customer's power supply after installation.

c. Not connected, the rectifier and the optional battery heater will be mounted during installation.

d. The fiber pigtail is equipped with one SC-type connector at one end.

Cable Installation and Wiring Procedures

This section describes each of the ONU cable installation procedures.

Checking the grounding

If you have not already done so, before beginning the cable installation, verify the ONU grounding integrity as follows:

Step 1. Open the door of the termination compartment of the ONU.

Step 2. Measure the connection from the framework to the approved earthing terminal according to local regulations.

Step 3. Ensure the electrical continuity of the connections among the following:

a. FRMGND (framework)

b. Approved ground conductor/terminal to which the grounding wire is connected

c. Framework of adjacent ONU housings if mounted

d. All cable sheaths

NOTE:
Voltages on ground circuits should be less than 1 V.

Step 4. If required measure the grounding resistance according to local regulations.

Checking the delivered cabling

Check the delivered cabling as follows:

Step 1. Verify that the visible factory wiring is free of broken, bent or misaligned connectors.

Step 2. Verify that all factory wiring is secure and tied into form.

Step 3. Verify that all cables are mounted

Step 4. Verify that all connectors are connected and secured. Fasten loose cables, as required.

NOTE:
Refer to label information attached to the ONU door of the electronics compartment to determine where cables should be connected.

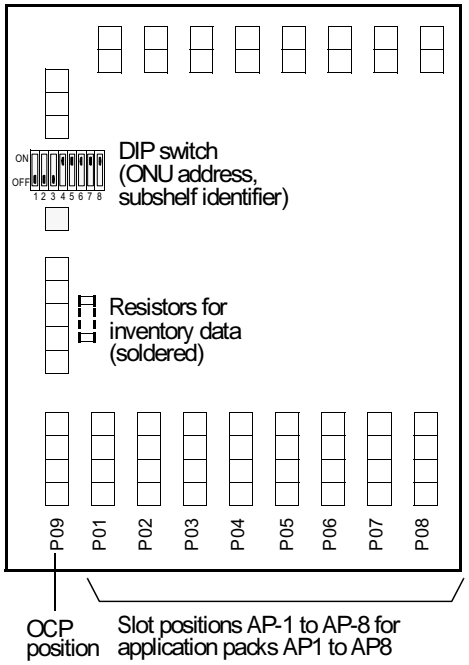


Figure 7-6 ONU backplane arrangement as viewed from the front (no pack inserted)

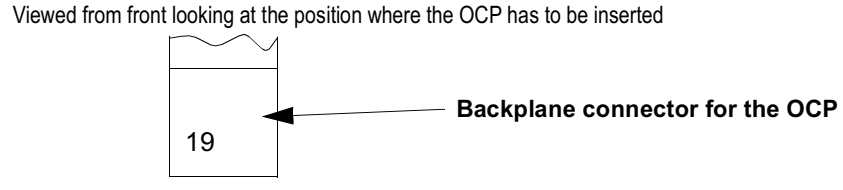
Setting the ONU shelf identifier

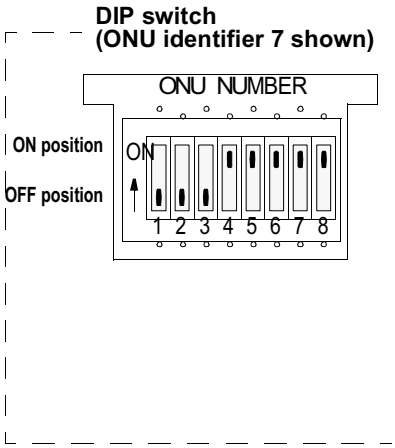
The ONU shelf is equipped with an 8-section DIP switch, located on the ONU backplane near the OCP position. The DIP switch is front-accessible when the OCP is not inserted. The switches are ON in the upper position (marked “ON”).

Use the following procedures to adjust the DIP switches:

Step 1. If required, disconnect the T/R cables and the blank faceplates of slots AP-1 to AP-4.

Step 2. Locate the DIP switch inside the ONU shelf on the left side of the backplane. Using a very small screwdriver, switch the 8 switches to ON/OFF as specified in the engineering work order. The switches are inverse binary coded. The address adjustments for ONU shelf identifiers 1 to 8 are shown in Figure 7-7.





ONU identifier adjustments:

ONU identifier	DIP 1 (2^0)	DIP 2 (2^1)	DIP 3 (2^2)	DIP 4 (2^3)	DIP 5	DIP 6	DIP 7	DIP 8
1	**OFF**	ON	ON	ON	ON	ON	ON	ON
2	ON	**OFF**	ON	ON	ON	ON	ON	ON
3	**OFF**	**OFF**	ON	ON	ON	ON	ON	ON
4	ON	ON	**OFF**	ON	ON	ON	ON	ON
5	**OFF**	ON	**OFF**	ON	ON	ON	ON	ON
6	ON	**OFF**	**OFF**	ON	ON	ON	ON	ON
7	**OFF**	**OFF**	**OFF**	ON	ON	ON	ON	ON
8	ON	ON	ON	**OFF**	ON	ON	ON	ON

Figure 7-7 DIP switch for ONU addressing

CAUTION:
Be careful when you are adjusting the DIP switches not to break or bend any backplane connectors.

Step 3. Re-check the ONU address carefully. It will be difficult to make corrections later because of the restricted space available after the application packs have been installed and cabled.

Step 4. Replace the blank faceplates and attach the T/R cables removed/ disconnected temporarily in Step 1.

Installing the Krone cross-connect

If you are installing an ONU with the base housing configuration, it will be necessary to mount the Krone cross-connect in the termination compartment, connect the T/R cables, and install the TAP-B cable (if appropriate). If you have not already performed these procedures, do so now. They are provided in Mounting and Installing the Optional Cross-Connect in Chapter 5, starting on page 5-3.

Marking the TAP100 cable (option)

Use one of the pre-installed T/R cables for the TAP100 cable.

The marking for the TAP100 cable and the connections to the TAP-B cable are only required if the optional test application pack TAP100 is installed. If no TAP100 is installed and the work order does not specify installing the TAP100-to-TAP-B cabling, proceed to “Installing the customer copper cables” on page 7-18 to continue the installation.

Use the following procedure to mark the TAP100 cable:

Step 1. If the slot for the TAP100 plug-in is known mark the appropriate T/R cable on the cross-connect side with the slot position and with “TAP100”.

Step 2. Locate the 4 wires for POTS port numbers 1 and 2 (tip and ring wire of subscribers 1 and 2) and mark them.

NOTE:
Only these 2 ports are used by the TAP100 for the test application path B. These 4 terminals must be connected to the TAP-B cable, which runs from the ONU, connector C1 (TAP), to the MDF. Five wires on the TAP-B cable are used for the test application path B; the fifth wire is reserved for future use (seizing). Figure 7-8 illustrates the cross-connect arrangement.

Interconnecting the test application paths (option)

The optional Test Application Pack (TAP100) is the internal test head that performs the measurements required for the drop.

Each AP can switch any of its subscribers to the General Purpose Bus (GPB). The subscriber can be switched either bridged (connection between port and subscriber line is kept) or split (connection between port and subscriber line is opened) to the GPB.

The TAP-B cable is a 13-wire cable of which only 5 wires are used. Four of them are for the circuit pair and the drop pair. The fifth one is for future use. The TAP100 cable is a normal 64-wire T/R cable of which only 4 wires are used (circuit numbers 1 and 2).

Figure 7-8 illustrates the cabling of the test bus, Table 7-2. lists the internal connections between the 4 active wires.

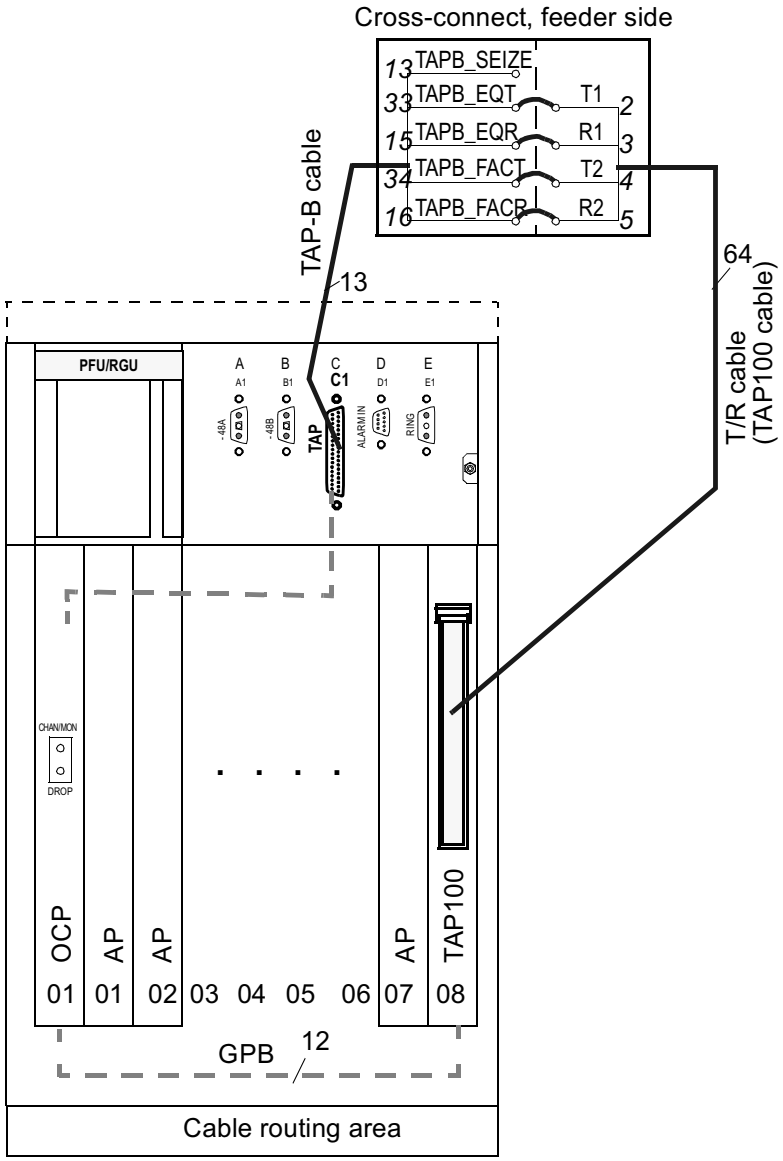


Figure 7-8 Cabling for integrated testing with TAP100 inserted in slot position AP-8 as an example

The subscriber lines of the application packs are numbered from 1 to 256 per ONU shelf. AP8 therefore would use terminals 225 to 256 of the cross-connect. The TAP-B cable would use terminals 257 to 271 of the cross-connect, for example. Any seven pairs of the terminals 257 to 270 of the feeder side of the internal cross-connect can be used for connecting the TAP-B cable.

As an example, the following 4 connections are required on the MDF when a TAP100 is used in the ONU shelf slot position AP-8:

Table 7-2. Cross-connections for TAP-B cable 848569257 and the TAP100 (example for TAP100 inserted in AP8)

TAP-B cable ED7C818-36 Gr1x from ONU shelf connection panel to the MDF				T/R cable ED7C818-30 Gr1x from the TAP100 to the MDF[a]			
Female conn. C1 (from male C1 on ONU)	***AnyMedia* signal for TAP-B**	**Wire[b]**	**MDF, TAP-B side** (example)	**MDF, TAP100 side** (example)	**Wire**	**Female TAP100 connector** (from male AP8 connector)	***AnyMedia* signal for TAP100**
1-12, 20-31	not used						
15	TAPB_EQ_R[c] (Ring, b-wire)	G-W	259b	224b	BL-W	3	TAP_EQ_R Equipment, (b-wire, port1)
16	TAPB_FAC_R[d] (Ring, b-wire)	BR-W	260b	225b	O-W	5	TAP_FAC_R Facility, (b-wire, port2)
33	TAPB_EQ_T[c] (Tip, a-wire)	W-G	259a	224a	W-BL	2	TAP_EQ_T Equipment, (a-wire, port1)
34	TAPB_FAC_T[d] (Tip, a-wire)	W-BR	260a	225a	W-O	4	TAP_FAC_T Facility, (a-wire, port2)
13, 14, 17, 18, 19, 32, 35, 36, 37	connected but currently not used						

a. Only the cross-connections are shown, for the TAP100 a normal aT/R cable is used with all 32 ports connected to the MDF.

b. Cable colors valid for the 848569257 cable.

c. Used for crossconnecting to the test application path for Equipment (corresponds to R1/T1 of TAP100 (1st POTS port)).

d. Used for crossconnecting to the test application path for Facility (corresponds to R2/T2 of TAP100 (2nd POTS port)); required for ISDN testing for example.

Installing the customer copper cables

The customer copper cable (also known as the outside plant cable) enters the ONU through the cable seal at the bottom of the termination compartment. Follow these procedures to connect this cable to the distribution side of the Krone cross-connect according to the work order or the requirements of the network provider.

WARNING:
Never install telecommunication wiring during a lightning storm or in a wet location.

Use a commercial tent to protect the cables and connectors during inclement weather.

Always equip the distribution side of the internal cross-connect with protector blocks/protector magazines.

Step 1. Verify that the copper cable is sealed and that the cable sheath is correctly grounded.

Step 2. Dress the copper cable so that the T/R pairs reach each module on the distribution side of the cross-connect. Note that the dressing is different for POTS/xDSL and xDSL-only applications: the POTS/xDSL cross-connect is 17.6 in (447 mm) long; the xDSL-only cross-connect is 26 in (663 mm) long.

Step 3. Remove the cable sheath so that the T/R pairs can be easily connected to each module on the distribution side of the cross-connect. Add cable ties as needed to dress the wire bundles, working from the end of the cable sheath to the bottom of the cross-connect mounting bracket.

Step 4. On the work order or the instruction sheet provided by the network provider, identify the connecting sequence and the color coding of the pairs to be connected.

Step 5. Remove the protector magazines on the distribution side, if required.

Step 6. Using the Krone insertion tool (Krone part No. 6417 2 055-01), press the first 10 pairs into the top row of connecting slots of the LSA PLUS disconnection module 1 and trim any access wire.

It is recommended that the modules be wired with the a-wire (Tip) terminated on the left position of each connecting pair when viewed from the front.

Comment: If you connect to the LSA 2/10 disconnection modules of the xDSL-only cross-connect, the T/R cabling connects to the bottom connection row of the disconnection module (marked with “1” to “10”).

Step 7. Record the copper cable termination assignments in the factory documentation.

Step 8. Repeat Step 6. and Step 7. for each remaining T/R pair.

Step 9. Insert all protection magazines removed in Step 5..

Step 10. Fold and secure any extra or unterminated wires.

Installing the cross-connect jumper wires

This section describes the procedure for crosswiring the feeder and distribution side of the Krone cross-connect for ONUs equipped with the ED7C851-56 Gr.1/2 cross-connect kits for POTS/xDSL applications.

NOTE:
If your ONU is equipped with the ED7C851-56 Gr.3 cross-connect kit for xDSL-only applications, the top connection row of each LSA 2/10 disconnection module is used for the feeder side, and the bottom connection row is used for the distribution side. There is no crosswiring required, and you may proceed to “Rerouting cross-connections for the ADSL service” on page 7-21.

Materials Required

A spool of 0.5 mm (24 AWG), single pair, solid cross-connect wire is recommended for cross-wiring; 0.4 mm wire is not recommended because of its limited strength and electrical fusing characteristic.The single-pair wire must have different colors representing the a-wire (tip) and the b-wire (ring).

Procedure

Install the cross-connect jumper wires as follows.

Step 1. From the work order or the instruction sheet provided from the network provider, identify pairs on the feeder side and the distribution side that must be connected.

Step 2. Remove the protector magazines on the distribution side, if required.

Step 3. Unwind about 3 to 6.5 ft (1 to 2 m) of the single-pair wire from the spool. Do not cut the wire from the spool.

Step 4. Using the Krone insertion tool (Krone part No. 6417 2 055-01) press the a- and the b-wire into the appropriate position of the LSA PLUS high-density connection module (gray side) on the feeder side and remove the trimmed wire.

Step 5. Dress the single-pair wire through the wire retainers located on both cross-connect parts to the connecting position on the distribution side. Ensure that about 4 in (100 mm) slack is left near each module.

Step 6. Using the insertion tool, press the a- and the b-wire into the appropriate position on the bottom connection row of the LSA PLUS disconnection module on the distribution side. The insertion tool should cut the wire from the spool.

Step 7. Record the cross-connection in the cable records.

Step 8. Repeat Step 1. through Step 7., as required.

Step 9. After all jumpers have been connected, wind the unused portion of the single-pair wire around the spool and tie to ensure it does not uncoil.

Step 10. Insert all protection magazines removed in Step 2.

CAUTION:
All *T/R cables, ISDN, HDSL and ADSL cables from the distribution side connected to the internal cross-connect must have primary protection unless cross connected to the APs of the ONU shelf (for example protector blocks).*

Rerouting cross-connections for the ADSL service

If your application includes ADSL APs for mixed configurations (POTS and xDSL), the engineering work order or the network provider will specify which POTS subscribers are to be provided with ADSL service. For these POTS subscribers (identified in the work order), refer to Figure 7-9 and reroute the cross-connects as follows:

- Disconnect the feeder-to-distribution cross-connection from the subscriber side and route it to the appropriate POTS input terminal for the ADSL AP on the feeder side of the cross-connect.
- Route the ADSL “output” terminal to the terminals on the subscriber side where the original POTS subscriber line was connected.

For the wiring of the ADSL AP connector see “Wiring of Connectors and Connecting Points of the ONU shelf” on page 7-23.

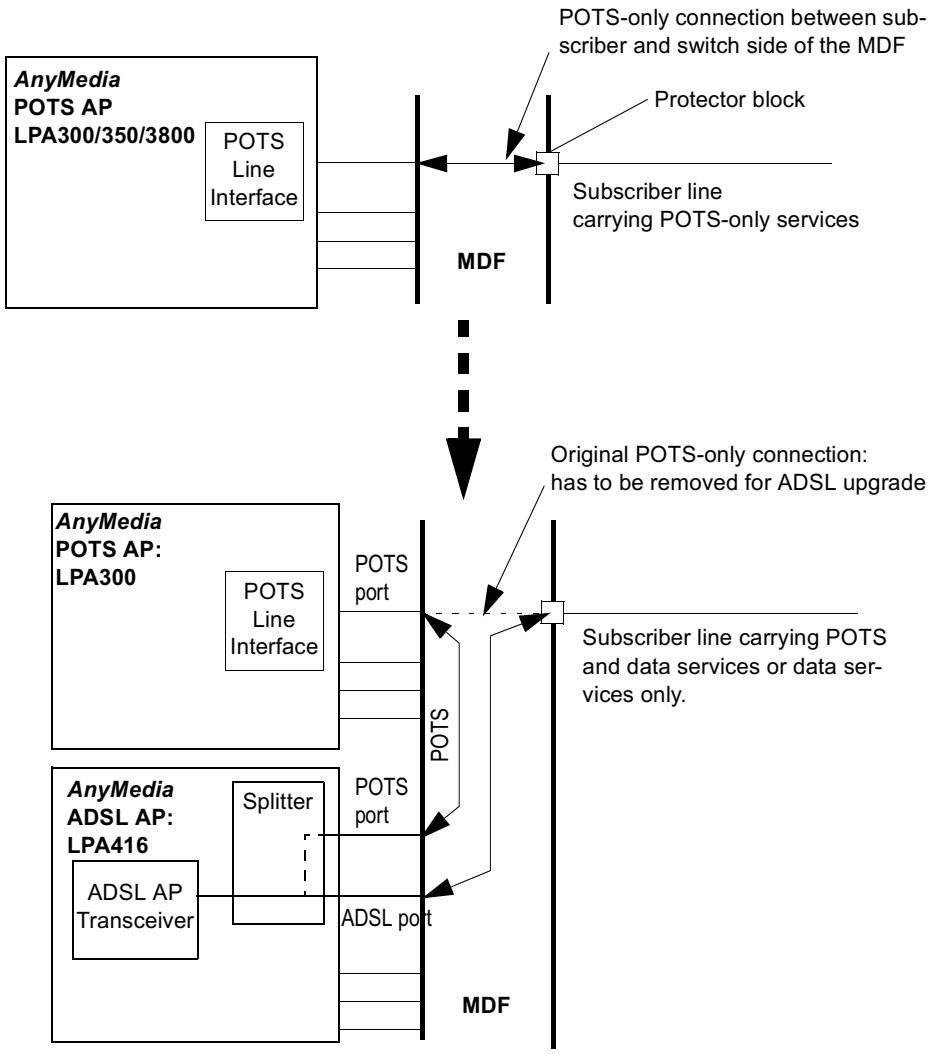


Figure 7-9 Principle for rerouting POTS over ADSL

Wiring of Connectors and Connecting Points of the ONU shelf

Figure 7-10 shows the connector arrangement of the ONU shelf.

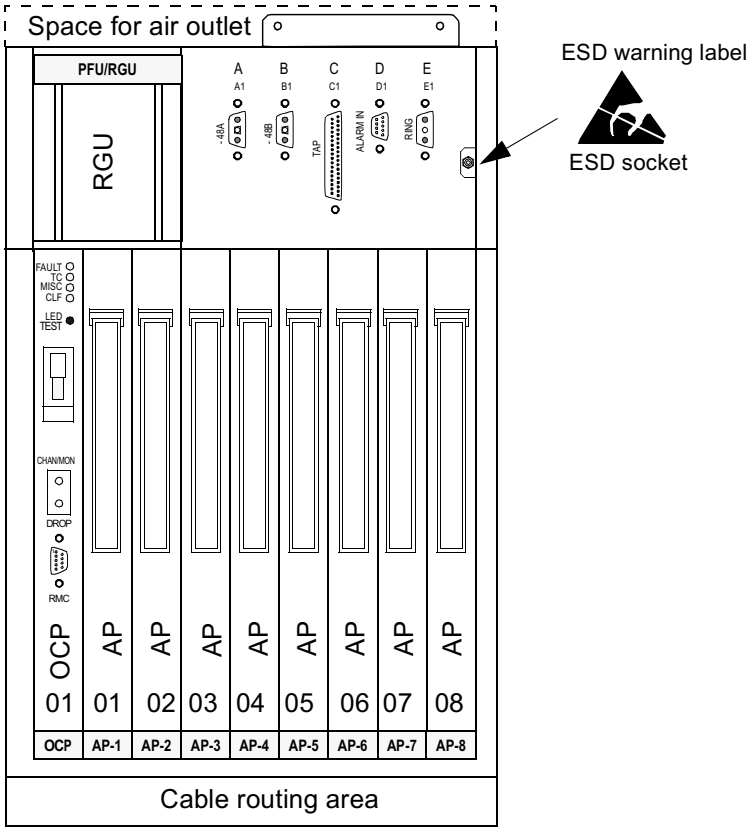


Figure 7-10 Pack Arrangement and Connector Arrangement of the ONU shelf

Connectors of the ONU shelf connection panel (SCP)

The figure below shows all connector positions of the ONU shelf connection panel (SCP).

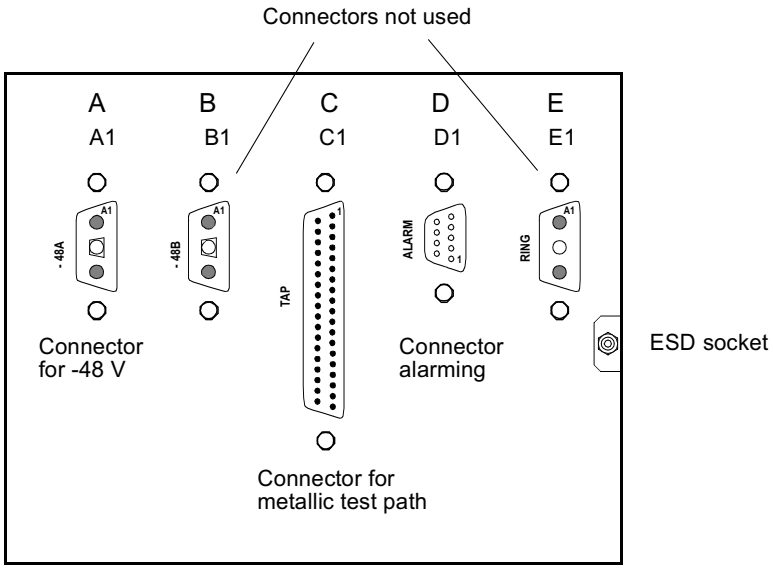


Figure 7-11 Connector Arrangement of the ONU Shelf Connection Panel (SCP)

Installing the Fiber

Fiber installation overview

The optical link between the ONU and the remote *AnyMedia FAST* shelf is through a single fiber connection between the optical controller pack (OCP) in the ONU shelf and the optical application pack (OAP) in the *AnyMedia FAST* shelf. The term “fiber installation” refers to the process of splicing, routing and connecting that single fiber at both ends. These procedures should be performed after the multifiber that contains that single fiber has been installed and tested.

The fiber installation process includes:

- At the remote *AnyMedia FAST* shelf: Splicing the single fiber with the *AnyMedia FAST* shelf fiber jumper and routing the fiber from the fiber termination box to the OAP.
- At the ONU site: Splicing the single fiber with the pigtail and routing the fiber from the fiber splice organizer to the ONU shelf (see Fiber cabling at the ONU on page 7-27).

Fiber link configuration

In most cases, the fiber routing between the *AnyMedia FAST* shelf and the ONU is as follows:

- From the OAP in the *AnyMedia FAST* shelf, an SC/SC fiber is routed to a fiber termination box containing two fiber connectors.
- From this fiber termination box, a pigtail runs to a fiber splice box where the fiber is spliced to the main multifiber. The multifiber is routed to the remote site where the ONUs are located.
- At the remote site, there is also a fiber termination box where the single fibers of the multifiber cable are routed to the ONUs.
- Each of these single fibers are spliced to a fiber pigtail which connects to the OCP via an SC-type connector.
- At the ONU, a fiber splice organizer is located in the termination compartment.

Optical link interface

The OAP and the OCP are equipped with SC-type fiber connectors.

Two wavelengths are used in the fiber link, one each for transmit and receive. The optical link parameters are listed in Table 7-3.

Table 7-3. Optical link parameters

Parameter	Value / Description
Fiber type	One single-mode fiber with wavelength division multiplexing (WDM) for bi-directional transmission
Connector type	Single connector, SC-type
Length	36 kfeet (≈ 10.9 km), maximum
Nominal wavelengths	1550 nm downstream (towards the ONU shelf); 1310 nm upstream (towards the network/*AnyMedia FAST* shelf)
Transmitted power	-8 dBm +/-2 dBm
Receiver sensitivity	-23.5 dBm or better
Reflection	max. -20 dBm

Installing the fiber at the remote *AnyMedia FAST* shelf

If necessary, install the single fiber at the *AnyMedia FAST* shelf location as follows:

Step 1. Remove the protective caps and test the SC/SC fiber jumper according to local practice. If testing is not specified locally, use an optical power meter and optical light source, such as the *Wavetek* OLP-6 or OLS-6 and OPL-15B or OLS-15.

Step 2. After testing, replace the protective caps on the fiber connectors.

Step 3. If required, clean the optical connectors on the SC/SC fiber jumper to avoid transmission loss and contamination of the mating connector/coupling. Cleaning procedures are provided in the next subsection (Cleaning optical connectors and couplings).

Step 4. After cleaning, use an optical microscope (enlargement >40) to verify cleaning results.

Step 5. Route the fiber from the fiber termination box to the OAP in the *AnyMedia FAST* shelf.

Step 6. Remove both protective caps of the fiber and place them inside the *AnyMedia FAST* shelf and in the termination box. The caps are required if the fiber is disconnected later.

Step 7. Connect the fiber to the OAP and to the fiber termination box. For *FAST* shelves that must be connected to multiple ONUs, the engineering work order identifies the specific fiber that must be connected to each OAP. Mark each fiber connector at the *AnyMedia FAST* shelf with the associated OAP number.

NOTE:
The SC-type connector is keyed to assure proper orientation for mating.

Step 8. Mark the fiber in the termination box. The marking should be specified in the engineering work order. If not, follow local regulations to mark the fibers.

If a fiber marking procedures is not specified, it is recommended that you mark each fiber with the *AnyMedia FAST* shelf/OAP number and mark the leaving fiber (towards the multifiber) with the ONU shelf identifier (ONU addressing), and with the ONU destination location.

NOTE:
Be sure that the main multifiber cable has been tested successfully from termination box to termination box using an optical time domain reflectometer (for example: *Wavetek* MTS5100) to test each fiber.

Cleaning optical connectors and couplings

For outdoor installations, fibers should always be checked for impurities and cleaned, if necessary, before they are connected. When it is necessary to clean any of the optical connectors or couplings at the *AnyMedia FAST* shelf or ONU sites, proceed as follows:

Step 1. Before cleaning the optical connectors, ensure that the optical source is switched off.

CAUTION:
Never look into the end of an exposed fiber or optical connector of a pack while the optical source is switched on. Always observe the laser warning instructions.

Step 2. For connectors, inspect the connector face for impurities (for example lint, dust particles, etc) using a microscope with an magnification factor of 200.

Step 3. For couplers, visually inspect the coupling for residual impurities by holding it to the light (the geometry of the coupling does not allow the coupling to be checked under the microscope).

Step 4. Use isopropanol for cleaning connectors or couplers.

Step 5. Let the connector/coupling face air-dry or use purified compressed air (the isopropanol must evaporate completely).

Fiber cabling at the ONU

Install the fiber cabling at the ONU as follows:

Step 1. Locate the separately delivered fiber pigtail per ONU with an SC-type fiber connector: Use Table 7-4 to identify the fiber pigtail.

Table 7-4. Delivered fiber cable for the ONU Shelf

Designation	Comcode	Equipment description	Length
Fiber pigtail	408415909	Fiber pigtail cable with SC-type connector, with protective spiral wrap of about 3 ft (≈1 m)	3 ft (≈1 m)

Step 2. Splice the pigtail to the correct single fiber of the office cable. Use the fiber reel to run the fiber to its source.

CAUTION:
There is a risk of causing microdefects or a risk of a cable break in the single fiber if the optical fiber bending radius is less than the minimum radius specified. Microdefects can increase the fiber attenuation and reduce the long-term stability. Ensure that the bending radius for the single fiber inside the ONU is not less than 1¼ in (30 mm).

Always use the fiber's special protective spiral wrap, if equipped.

Step 3. Mark the fiber in the fiber splice organizer. The marking should be specified in the engineering work order. If not, follow local regulations.

If a fiber marking procedures is not specified, it is recommended that you mark each fiber with the ONU shelf identifier (ONU addressing) and mark the incoming fiber (from the multifiber) with the OAP slot position and *AnyMedia FAST* shelf destination location.

Step 4. If required, splice and route the other single fibers back to the outgoing fiber office cable.

NOTE:
The fiber splice organizer in the ONU is designed to hold a maximum of six single fibers.

Step 5. If required, remove the protective cap of the spliced fiber and test the fiber according to local regulations. If fiber testing procedures are not specified, use an optical power meter (for example, the Wavetek OLP6/OLS16). After testing, replace the protective caps on the fiber connectors.

Step 6. If required, clean the optical connectors on the SC/SC fiber jumper to avoid transmission loss and contamination of the mating connector/coupling. Cleaning procedures are provided in "Cleaning optical connectors and couplings" on page 7-27.

Step 7. Insert the fiber pigtail through the opening behind the organizer to the electronic compartment of the ONU.

Step 8. If you haven't already done so, open the door of the electronic compartment of the ONU and latch the door in position.

Step 9. Locate the fiber pigtail just inserted on the left side and route the fiber with the protective spiral wrap side to the OCP position of the ONU shelf.

Step 10. Arrange the fiber with the previously installed T/R cables on the left side of the ONU housing and dress them horizontally. Add cable ties as needed.

Step 11. Mark the fiber connector with the ONU shelf identifier (ONU addressing) if more than one ONU is located on the site.

Step 12. If no OCP is inserted, replace the protective cap on the fiber connector. Put the fiber connector between the left ONU housing side and the ONU shelf where the fiber will be protected.

Step 13. If the OCP is in place, remove the protective cap from the SC-type fiber connector of the OCP and place it inside the ONU shelf.

Step 14. Orient the mating fiber connector so that the fiber routes upward toward the OCP. For the cabling arrangement inside the ONU shelf see Figure 7-2, Figure 7-3, and Figure 7-4.

Step 15. Affix the fiber with care to the grounding bracket fingers of the ONU shelf directly below the OCP. Do not over-tighten the tie.

Connecting AC Power

8

Overview

This chapter describes the requirements and procedures for connecting the ONU to the local electric utility.

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■ **AC Power Supply Service**	8-2
Utility power arrangements	8-2
AC cable routing	8-3
Grounding the ground wire	8-3
■ **Connecting to the AC Utility**	8-4
Precautions	8-4
Checking the AC power supply	8-4
Connecting the AC power supply	8-4
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AC Power Supply Service

Utility power arrangements

If necessary, make arrangements with the local power company to furnish a suitable power drop to the ONU site. The power company will determine if an external power meter (watt-hour) is required. Grounding of AC connections should conform to state and local codes and applicable practices.

AC cable routing

After the ONU is installed on the pad, route the AC cable to the ONU as illustrated in Figure 8-1 and insert the AC power cable through the left opening/grommet in the ONU cable entrance area.

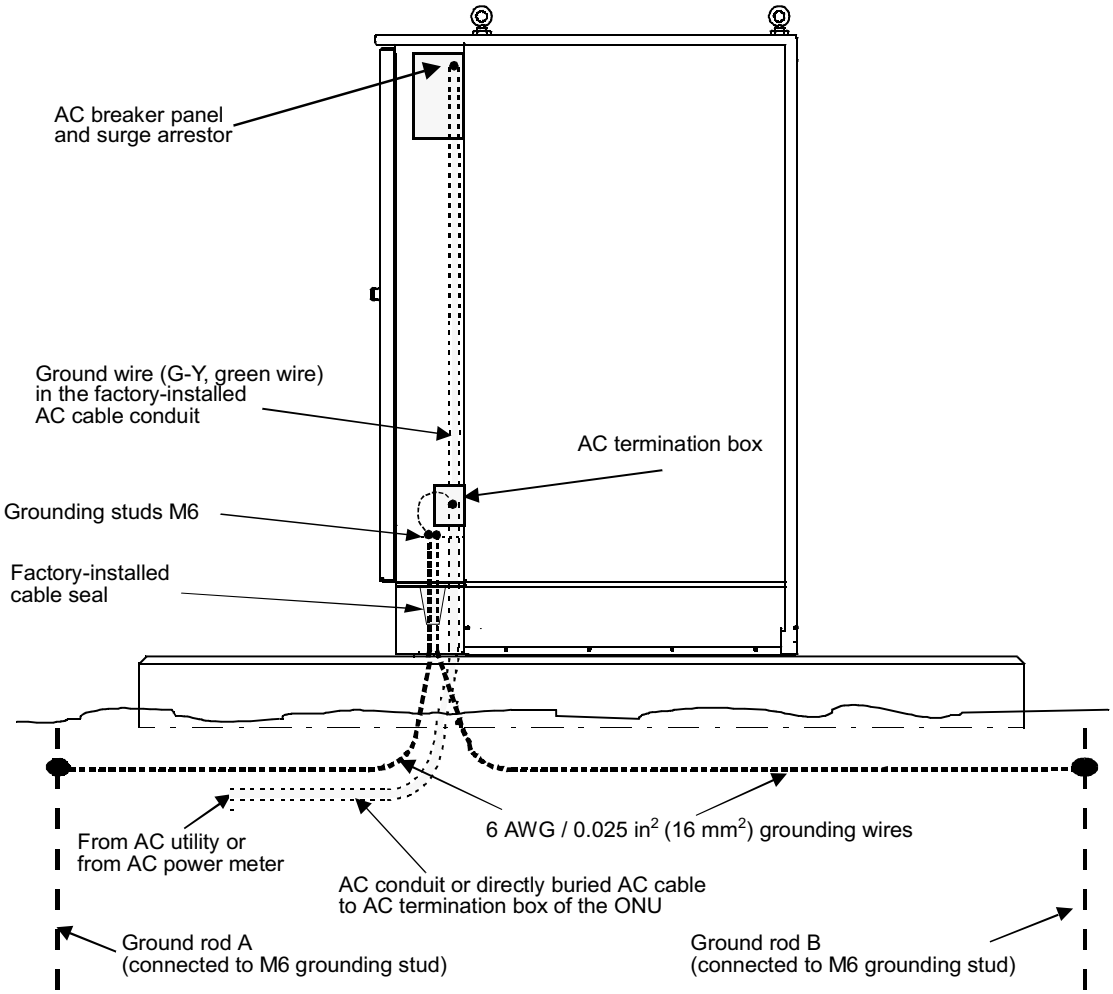
AC breaker panel
and surge arrestor
Ground wire (G-Y, green wire)
in the factory-installed
AC cable conduit
AC termination box
Grounding studs M6
Factory-installed
cable seal
From AC utility or
from AC power meter
6 AWG / 0.025 in² (16 mm²) grounding wires
AC conduit or directly buried AC cable
to AC termination box of the ONU
Ground rod A
(connected to M6 grounding stud)
Ground rod B
(connected to M6 grounding stud)

Figure 8-1 AC routing from AC utility and grounding

Grounding the ground wire

Connect the ground wire to the M6 ONU housing grounding stud.

When connecting to TN-C systems, an additional N-pole to ground pole connection is required inside the ONU between the ONU AC distribution .

Connecting to the AC Utility

Precautions

Ensure that the ground green wire of the AC cable is connected to the central approved grounding point according to local regulations.

NOTE:
Check the ONU grounding connections before you connect the AC power supply. Procedures for verifying the grounding connections are provided in Checking the Ground Connections on page 6-18.

WARNING:
Hazardous voltages are present on the AC cable. Follow all safety warnings and practices when installing and servicing this equipment.

Checking the AC power supply

Before connecting the ONU to the AC power supply for the first time check the following items:

Step 1. Measure the voltage on the utility power supply and verify that it is in the range as stated in the engineering work order.

Step 2. Verify that the utility power supply is switched to “OFF” and cannot be turned on accidently. Mark the OFF state if required. Follow local regulations for securing and marking the power supply.

Step 3. Verify that the cable is de-energized. If required, short the deactivated power supply to ground. Follow local regulations.

Step 4. Verify that the AC circuit breaker of the ONU is switched to OFF.

Step 5. If you have not already done so, remove the cover of the AC termination box in the termination compartment.

Step 6. Verify that the AC power supply cable from the ONU AC termination block is routed to the utility side. Do not connect.

Connecting the AC power supply

If the AC cable is not connected, connect the AC cable as follows:

NOTE:
The diameter and the length of AC cable used for connecting to the AC utility must be consistent with the cut-off conditions of the primary fuse/ breaker.

Step 1. Strip the AC power supply cable long enough so that the cable can be connected securely on the AC utility side. Strip each of the three

wires to a length according to the terminals used in the AC utility side.

Step 2. Insert the ground wire into the ground terminal and screw tight or connect/fix. Connect the L1 and L2/N wire as prescribed by the local power company.

Step 3. Cut the AC cable so that it reaches the termination clamp of the AC termination box.

Step 4. Strip the wires so that they can be connected to the terminals of the termination box.

Step 5. Connect the wires as shown on the decal of the termination box.

NOTE:
The terminals inside the AC termination box are designed for solid wires, 6 to18 AWG.

Step 6. Insert the brown and the blue wire into the correct terminals for L1 and L2/N and screw tight or connect/fix. Follow local regulations for these connections.

Step 7. Check that the wires are dressed.

Step 8. Replace the cover of the AC termination box in the ONU termination compartment.

Step 9. If you previously shorted the deactivated power supply on the utility side, remove the short. Follow local regulations.

Step 10. Verify that the AC breaker of the ONU is switched to OFF and that all covers of the AC termination box and the AC breaker panel are mounted. Bear in mind that the AC cable is energized. If required, mark on the AC breaker panel that the ONU is energized.

Step 11. If you are continuing with the ONU installation, switch the AC utility to “ON.”

Step 12. It is recommended that the connection to the AC utility be documented. Also a label should be attached inside the ONU indicating the type of AC distribution, the installation date and the installation point to which the AC is connected. If the AC utility connection point is not freely accessible by service personnel, the telephone number of the local power company should be included in the documentation.

Step 13. Verify that all cable seals, grommets and the other gaps at the bottom of the cable entrance in the termination compartment are still properly sealed, see Sealing and Caulking the ONU Cables on page 6-19.

Step 14. Latch the termination compartment door in position.

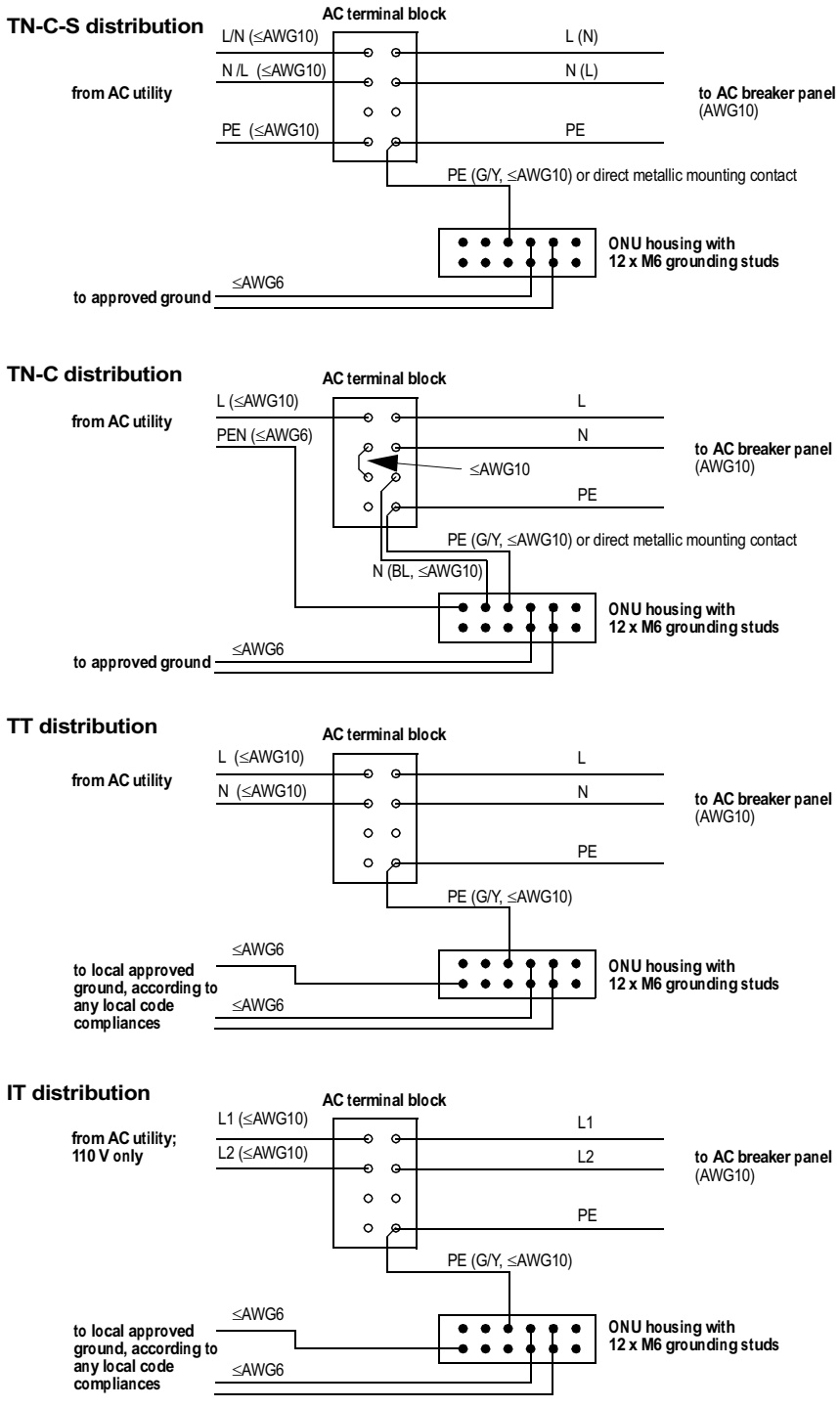

Figure 8-2 AC connection variants

Connecting to the auxiliary power generator

An external power generator can be connected to protect against permanent loss of AC power. A special raw ended power cord with an IEC 60320 plug is provided (Comcode 848506820) for this purpose. This plug must be inserted into the IEC 60320 inlet of the ONU instead of the power cord coming from the AC breaker panel.

Installing the Batteries

9

Overview

This section provides the procedures for unpacking, inspecting, and mounting the batteries in the ONU battery compartment.

NOTE:
If you are familiar with the battery installation and with the storage/charging procedures and warranty considerations, you can skip to page 9-9 and begin by unpacking the batteries.

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■ **Battery Safety**	9-5
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Battery Option

Ordering Batteries

The standard configuration of the outdoor *AnyMedia* ONU does not include batteries. However, the housing is designed to accept four optional type IR-40EC batteries, which are available from Tyco. For ordering information, see the *AnyMedia® Access System (24 Channel) Ordering Guide*, 363-211-125.

For standard installation and connection of the batteries, no special tools are required. The insulated tools listed in Tools and Measurement /Testing Instruments on page 3-4 are required for maintenance, repair, or mounting batteries.

Battery description

The batteries are equipped with a 14 AWG lead assembly with a polarized 2-pin connector. The battery cable to the LVD is equipped with four matching connectors.The batteries are illustrated in Figure 9-1. The optional batteries will be delivered packed in a wooden box containing the following:

Table 9-1. Delivered battery set

Qty.	Comcode	Type	Consisting of:
4	407928753	IR-40EC	12-volt, valve-regulated, lead-acid IR Series I battery, with 14 AWG lead assembly terminating with pre-connected 2-pin AMP-type plug
1	107078859	157-622-020	Product Manual IR Series Batteries (Issue 7 or later)
8			Screws (2 per battery, thread 10-32 x 0.50)[a]
1			Battery type label[b]

a. Already assembled for the 14 AWG lead assembly. **Note:** These screws are not M5 screws.

b. Sticker already attached to the battery. Used for marking the installation date, see Figure 9-4.

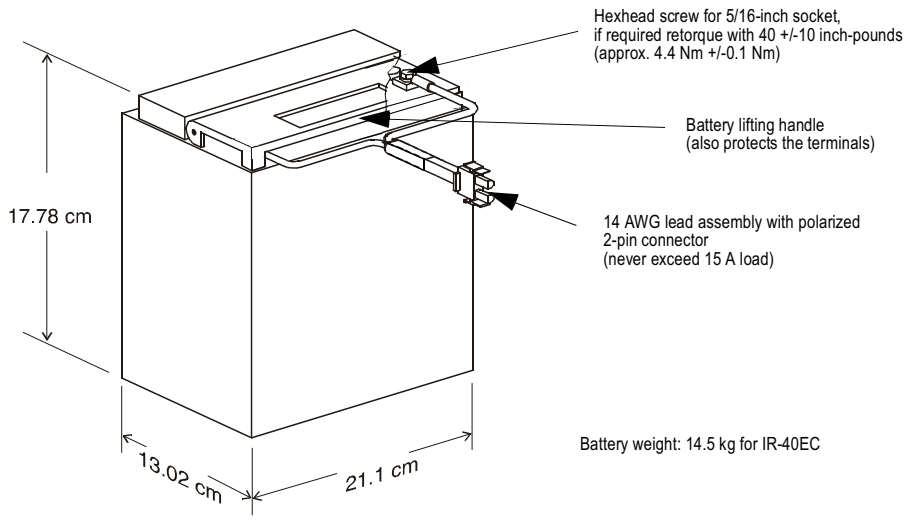
Hexhead screw for 5/16-inch socket,
if required retorque with 40 +/-10 inch-pounds
(approx. 4.4 Nm +/-0.1 Nm)
Battery lifting handle
(also protects the terminals)
17.78 cm
14 AWG lead assembly with polarized
2-pin connector
(never exceed 15 A load)
Battery weight: 14.5 kg for IR-40EC
13.02 cm
21.1 cm

Figure 9-1 IR-40EC battery

Battery Safety

General safety precautions

For safe battery handling, always observe the following basic precautions:

- Use only properly insulated tools and test equipment.
- Remove all metallic objects (key chains, glasses, rings, watches, or any other jewelry).
- Wear safety glasses, acid-resistant gloves, rubber overshoes and apron.
- Test circuits before touching.
- Lock out and tag any circuit breakers or fuses whenever possible to prevent accidental turn-on.
- Be aware of potential hazards before servicing equipment.
- Do not short the battery.
- Identify exposed hazardous electrical potentials on connectors, wiring, etc. (Note the condition of these circuits, especially any wiring).
- Take care when removing or replacing any covers or brackets. Avoid contacting terminals.
- Always verify the polarity before connecting cables to the batteries.
- Use a damp soft cloth for cleaning batteries. Do not use solvents, paraffin, abrasive or proprietary cleaning fluids.

While unpacking and/or installing the batteries:

- Never place metal objects (including tools) on top of a battery.
- Never short out the battery terminals.
- Never use an open flame near batteries.
- Never stack batteries (in or out of their shipping cardboard boxes).
- Never transport or move batteries so that their weight is supported by the terminal connections.
- Never charge batteries that are visibly damaged or frozen (typically at temperatures below -40°C if the battery is fully charged).

Gas discharge

All lead-acid batteries generate hydrogen gas, even under open circuit conditions. If not permitted to escape, this gas can build up to explosive concentrations. An explosion could occur when sparks are created near the battery string. Do not place batteries in a sealed enclosure. Freshly charged batteries are especially prone to discharging explosive gases for about 24 hours after charging.

Sparks

To avoid sparks, ensure that batteries are not charging or discharging before loosening or removing battery connections. Sparks can trigger an explosion and short circuit other battery modules, causing a fire. The GMT-type fuse in the LVD can produce sparks during interruption or clearing of a fault on a high energy circuit. Any mechanical power switches and also static electricity are sources of spark gaps.

Short circuits

Be very careful when taking voltage readings to prevent accidental grounding or shorting of leads during measurements. Connections at the meter must be secure and free of any possibility of touching or becoming grounded. Never remove connections at the meter end without first disconnecting the test leads from the battery. Remove test lead connections at the battery immediately after each reading is taken.

WARNING:
Exercise extreme care to avoid any short circuit across the battery terminals. Even a single battery poses a potentially high energy hazard if shorted. Shorting a battery may result in explosion of the battery, injury to the installer, and damage to equipment. A tool or other metallic object causing the short may be thrown or vaporized due to the battery energy.

Conductive surface

If the battery is to be installed on an electrically conductive surface, a non-conductive mat or surface should be placed between the battery and the conductive surface.

Contact with electrolyte

In the event of electrolyte contact with the skin, remove the electrolyte immediately by rinsing the affected area with large amounts of plain tap water. In the event of electrolyte in the eye, pour water into the inner corner of the eye and allow at least one liter of water to run over the eye and under the eyelid. Eye injuries should be treated by a physician immediately.

Acid spills

If large acid spillage occurs, use agricultural or industrial lime instead of soda for neutralization before cleanup. If lime is not available, you may use baking soda. Wear eye protection devices and rubber gloves when using lime on electrolyte spills. Sprinkle the lime on the spillage; allow it to absorb the electrolyte, and then sweep it up and dispose of it in the proper manner. Wash hands and face thoroughly after cleanup.

Battery Handling and Preparation

The following describes how to install the Tyco IR-40EC battery string. It also provides test procedures for verifying the integrity of the installation.

NOTE:
Batteries should be installed after all cables have been installed.

The regulations for storage, handling, external charging, and maintenance are different for each battery manufacturer. For IR-40EC batteries, follow the regulations given in the Product Manual for IR Series Batteries.

Required tools, supplies and equipment

You will need the following tools and materials to install and test the battery string:

- Splash-proof safety goggles, acid-resistant gloves, rubber overshoes, and apron
- Cleaning cloth
- Lime and/or soda (sodium bicarbonate)
- Insulated socket driver or nut driver set (1/4-inch through 3/4-inch sockets) and torque wrench (0 to 60 in-lbs, 6 Nm) for maintenance/replacement only
- Sandpaper or abrasive cloth for cleaning the battery compartment only
- DMM (Digital Multimeter), for example, Tek DM254 or *Fluke* 8060A or equivalent. The accuracy of an equivalent meter should be 0.05 percent on the DC scale.
- Current converter or current probe 1:10 for multimeter used for up to 20 A
- Thermometers for measuring the ambient temperature and the battery temperature (contact type)
- Waterproof fine line marker for marking batteries and the connectors, also required to write the installation date onto the batteries.
- A Class C fire extinguisher (kept within reach)

Battery handling

Before handling batteries, read and understand the sections of the *Product Manual IR Series Batteries* that apply to IR-40EC batteries.

When removing containers from the shipping van, place them on a dolly truck in their horizontal shipping positions. Verify that the containers have not been damaged. It is important that all containers be handled with care and not dropped.

The weight of the packed batteries in their shipping container is about 132 lbs (60 kg) for four batteries of type IR-40EC. Do not apply silicone grease to IR-

40EC batteries, as this can interfere with the battery housing and other electronic components.

Shipping and storing IR-40EC batteries

When transporting crates or storing them in a warehouse, do not stack more than two battery shipping containers high. Always store the shipping container in the upright position as marked on the container. Provide adequate ventilation during storage.

Storage time limit

The IR-40EC batteries are shipped in a charged state. The open circuit voltage for a fully charged battery is: 12.84 to 12.96 V.

Batteries may suffer irreversible capacity loss if stored in the open circuit state for a long period without recharging. The maximum time that a fully charged IR-40EC battery may remain on open circuit is 6 months at a temperature of 25°C, or 3 months at temperatures exceeding 32°C. The date by which the battery must be recharged is stamped on the cardboard shipping box (see Figure 9-2.

NOTE:
Depending on where the battery was manufactured, the charging date may also be found on a sticker attached to the battery housing.

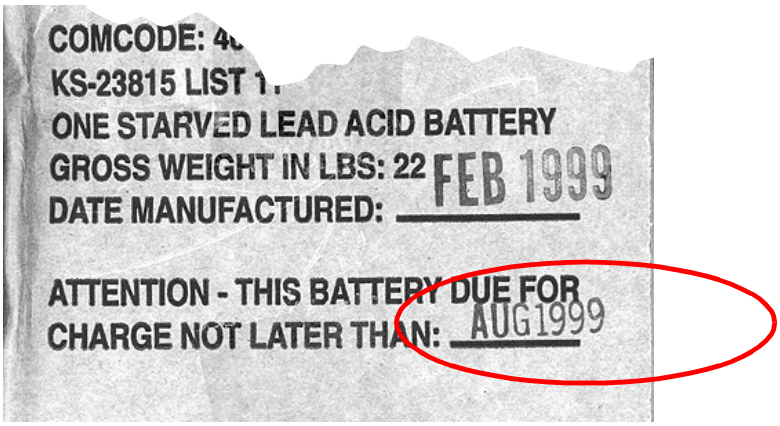
COMCODE:
KS-23815 LIST
ONE STARVED LEAD ACID BATTERY
GROSS WEIGHT IN LBS: 22
DATE MANUFACTURED: FEB 1999
ATTENTION - THIS BATTERY DUE FOR
CHARGE NOT LATER THAN: AUG1999

Figure 9-2 Example for a cardboard box with “charge no later than” date

Initial charging

If the batteries cannot be installed within the indicated time period, they must be charged externally. Follow the instructions in the chapter “Initial Charging” in the Product Manual for IR Series Batteries. A copy of these instructions is included in Figure 9-3.

The purpose of the initial charge is to compensate for self discharge that occurs in the interval between manufacture and installation. Under normal circumstances, the battery will regain most of its capacity after several hours on float charge; 90% capacity should be obtained within 24 hours of float charge.

Battery Condition	Action
All batteries have similar date codes and storage histories and none are more than 6* months old or they have been maintained according to the *Battery Storage* section of this product manual.	Make voltage and polarity checks and connect string(s) to plant. Charge at the float voltage of 13.5 ±0.06 volts per battery
The batteries have dissimilar date codes (more than one month apart) and they are within the required recharge period (charge-by date).	Using an external charger**, charge the string at 13.98 ±0.06 volts per 12V battery for 24 hours. Continue the charge for another 24 hours at the plant float voltage: 13.5 ±0.06 volts. Make voltage and polarity checks and connect the string(s) to the plant
The batteries are older than 6* months or have not been maintained according to the *Battery Storage* section of this product manual.	Do not install. Replace batteries.
*If the storage temperature exceeds 90°F (32°C), the open circuit time should not exceed 3 months. ** The charger must have overcurrent protection in its output, must be able to remain across the batteries in case of an AC power failure, and should not have crowbar protection. (Crowbar protection is an option used on some commercial portable power supplies that clamps a short across the output lead of the rectifier when the rectifier senses a higher voltage at the load than it is generating. This feature should not be used with batteries.)	

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COPY of the Tyco Product Manual IR-30EC and IR-40EC Batteries (Issue 7, Comcode 107078859)

Figure 9-3 Copy of the initial charging recommendation of IR-40EC batteries

NOTE:
If batteries are older than the allowed open circuit time and have not been maintained in this period, they must not be installed and should be replaced.

Unpacking and completeness check

Use the following procedure to unpack the battery and check the shipment for completeness:

Step 1. Move the pallet with the wooden box containing the batteries and the battery accessories in close proximity to the ONU.

NOTE:
Use appropriate material handling equipment to move the battery pallet. An IR-40EC battery weighs about 33 lbs (15 kg).

Step 2. Using slip joint pliers, remove all the staples/nails from the wooden battery shipping container and dispose of them properly.

Step 3. Locate the loose parts delivered with the batteries including the Product Manual IR Series Batteries (Issue 7 or later, Comcode 107078859).

NOTE:
If there are any problems with the delivered equipment or if any items are missing, refer to the job specification or equipment order for the name and telephone number of the local manager to contact and to rectify the problem.

Step 4. Locate the Installation and Maintenance Record in the Product Manual IR Series Batteries and reproduce it or use the copies in Appendix A Installation and Maintenance Record

Use the installation and maintenance record to record the parameters measured during installation and at quarterly maintenance procedures. The completed forms will be required for warranty validation.

Battery inspection and initial charging

Use the following procedure to inspect the battery and prepare it for installation:

Step 1. The packing list includes the order number. Record this order number in the Installation and Maintenance Record.

Step 2. Take out the first battery and place the battery on a level surface.

Step 3. Inspect the battery for shipping damage/obvious damage and for any sign of acid spillage.

Step 4. Check the battery for fractured housings. Batteries with fractured housings are defective and must not be used. Return damaged batteries to the manufacturer in their original packing.

Step 5. Mark the first battery, the 2-pin connector and the cardboard box with the numeral 1. This number is required for the installation record.

Step 6. Verify that the battery has not reached the open circuit time limit (see Figure 9-2).

Step 7. Follow the instructions for *Initial Charging* in the Product Manual IR Series Batteries (see Figure 9-3). Observe the battery

manufacturer's charging requirements. Charging procedures are vendor-specific and can vary for different battery types.

NOTE:
Return damaged batteries to the manufacturer. Record any indications of acid spillage on the bill of lading before signing it. Acid spillage is a valid criterion for rejecting a battery. If it is determined that the battery should be returned to the manufacturer, it will be easier to return at this point than if the battery has been installed.

Step 8. Note this battery number and the battery serial number, which can be found on the battery sticker in the Installation and Maintenance Record. Refer to Figure 9-4 for the location of the serial number.

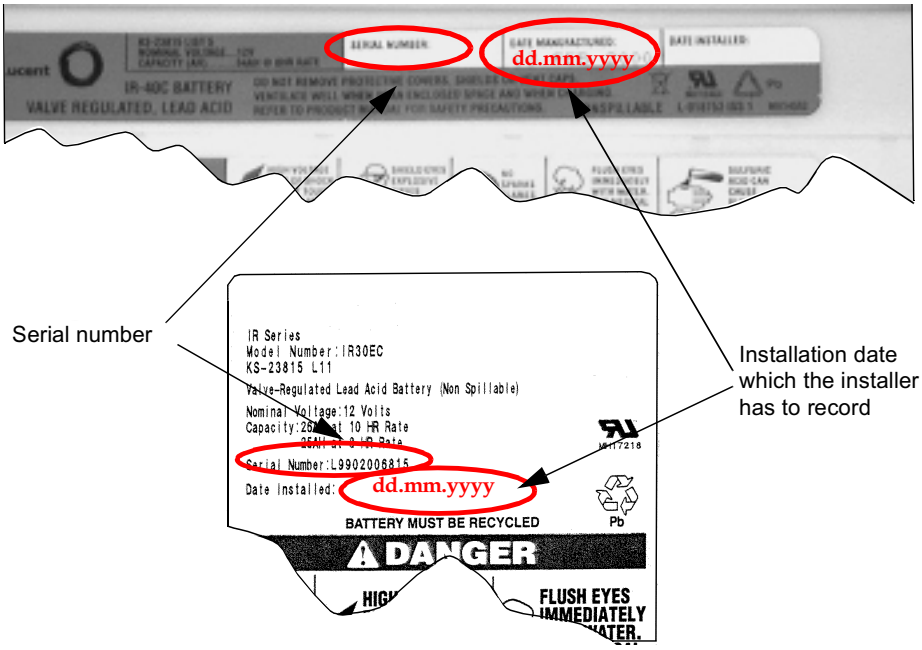

Figure 9-4 Battery labels showing the battery serial number and installation date

NOTE:
Depending on the manufacturing site, the serial number may also be found on a sticker attached to the battery housing.

Step 9. Measure the open circuit voltage of Battery 1 and record it in the Installation and Maintenance Record.

NOTE:
Only in a running system may the IR-40EC battery be discharged to 10.5 V.

NOTE:
If the battery voltage is 12.84 V or below, the complete battery string must be charged by the internal power rectifier unit immediately after mechanical installation. Otherwise, the batteries must be charged externally.

NOTE:
If the measured battery voltage is below 12 V the battery should be considered defective (cell short) and may not be installed.

Step 10. Note the installation date on the sticker of each battery and also in the Installation and Maintenance Record in the field *Date Installed*.

Step 11. Repeat Steps 4 to 10 for the other 3 batteries, marking them sequentially 2 though 4 in Step 5.

Installing the Batteries

Battery arrangement

Figure 9-5 and Figure 9-6 illustrate the empty IR-40EC battery compartment and the battery arrangement, respectively. The battery compartment is located in the lower part of the electronics compartment of the ONU housing.

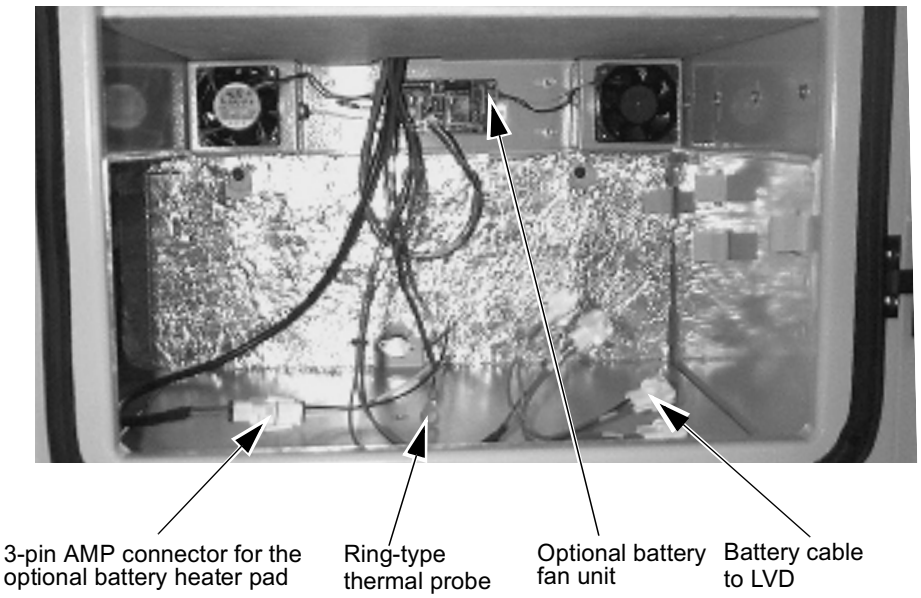
3-pin AMP connector for the optional battery heater pad
Ring-type thermal probe
Optional battery fan unit
Battery cable to LVD

Figure 9-5 Empty battery compartment (battery hold down bracket removed)

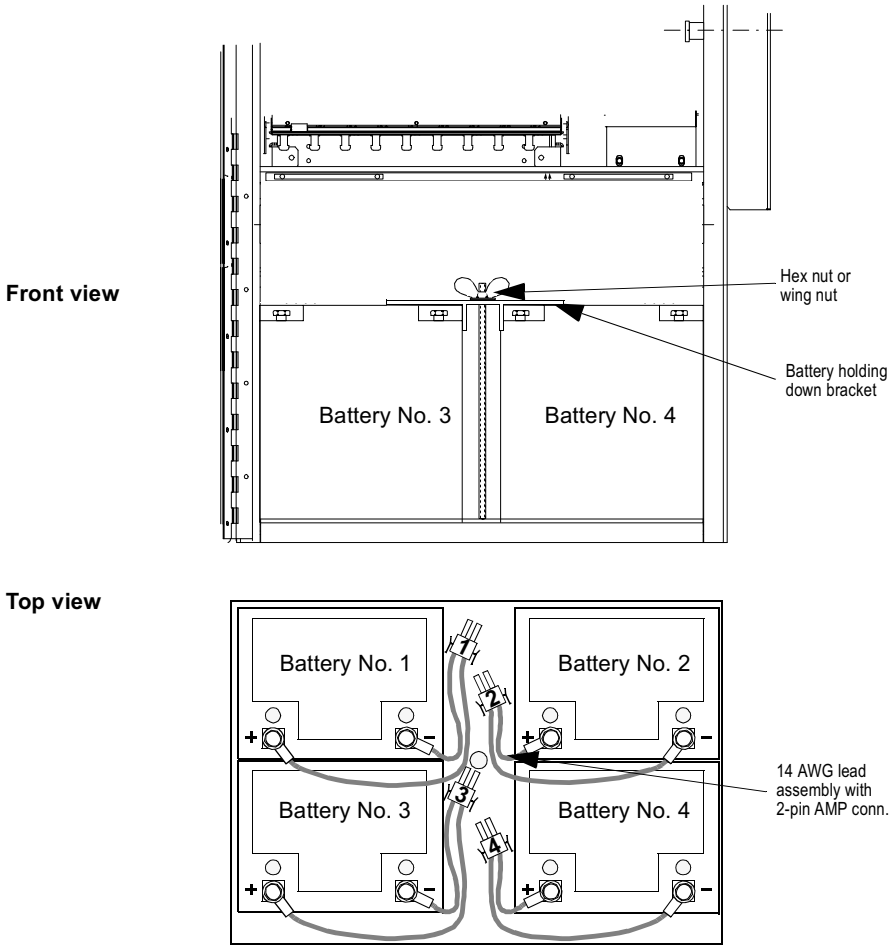

Figure 9-6 Outdoor application battery arrangement (only the 14 AWG lead assembly shown)

Installation procedure

Place the batteries in the battery compartment and secure them as follows:

Step 1. If the LVD is equipped, ensure that the battery circuit breaker is switched OFF. Refer to Figure 10-1 on page 10-3 for the location of the LVD.

WARNING:
When you mount the batteries in the ONU battery compartment, observe the safety precautions provided in Chapter 1 Safety.

Step 2. If the PRU is equipped, ensure that the AC power cord is not connected. Refer to Figure 10-1 on page 10-3 for the location of the PRU.

Step 3. Loosen and unscrew the wing nut that secures the battery hold-down bracket and remove this bracket.

Step 4. Unscrew the long threaded rod temporarily. If necessary, use pliers to turn it counterclockwise to unseat the shaft.

NOTE:
Do not grip the rod at the top. Grip it only on the middle or lower portion. Do not try to insert the rear batteries before the rod is removed.

Step 5. Locate the battery cable and the ring-type thermal probe cable and move them out of the way.

Step 6. Position the first battery (No. 1) with its terminals facing to the front in the rear left corner of the battery compartment as shown in Figure 9-6. Move the 2-pin battery assembly to the right.

Step 7. Repeat with the second battery (No. 2) and position it in the rear right corner of the ONU. Move the 2-pin battery assembly to the left.

Step 8. Replace and secure the long threaded rod that you removed in Step 4..

Step 9. Position Batteries 3 and 4 as shown in Figure 9-6.

Step 10. Move Batteries 1 and 3 and also Batteries 2 and 4 close together and move them to the side walls of the housing.

Step 11. Verify that the connector J3 on the rectifier side is not connected.

Step 12. Connect the keyed 2-pin plugs of the batteries to the appropriate connectors of the battery cable and arrange the battery cabling in the free space between the batteries.

Step 13. Measure the battery string voltage on the outermost pins of the battery cable connector J3 and record in the Installation and Maintenance Record.

Step 14. Verify that the batteries are connected properly and that the polarity is correct.

Step 15. Inside the battery compartment, locate the thermal probe (Figure 9-5) and insert the ring-type terminal between the metallic case and the battery housing of Battery 3, as shown in Figure 9-7.

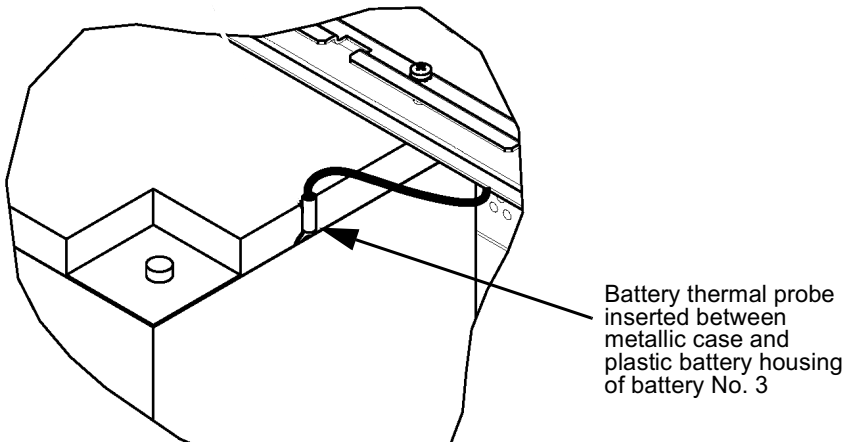

Figure 9-7 Position of the ring-type thermal probe

Step 16. Locate the battery hold-down bracket. Mount and tighten the wing nut as shown in Figure 9-8.

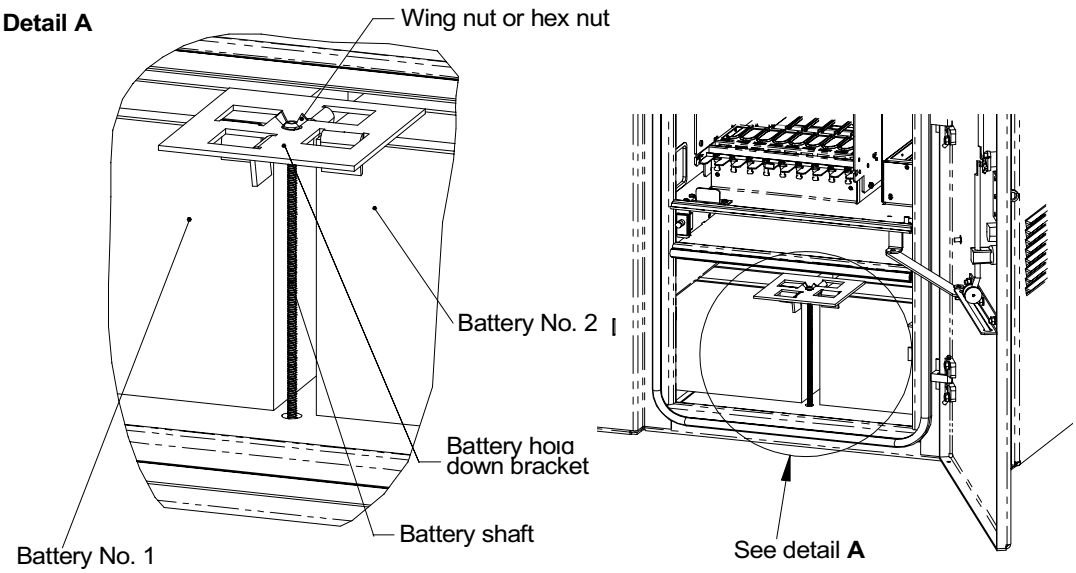

Figure 9-8 Mounted batteries (Batteries 1 and 2 already inserted; Batteries No. 4 and No. 5 to be inserted)

System Power Up

10

Overview

This chapter provides the procedures for installing power-related modules, applying AC power and activating the batteries.

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Installing the Power and Ringing Modules

The next three sections explains how to install the power rectifier unit (PRU), low voltage disconnect (LVD) and ringing generator unit (RGU) modules in their assigned shelf positions, as illustrated in Figure 10-1. The ordering codes for these modules are listed in Table 10-1.

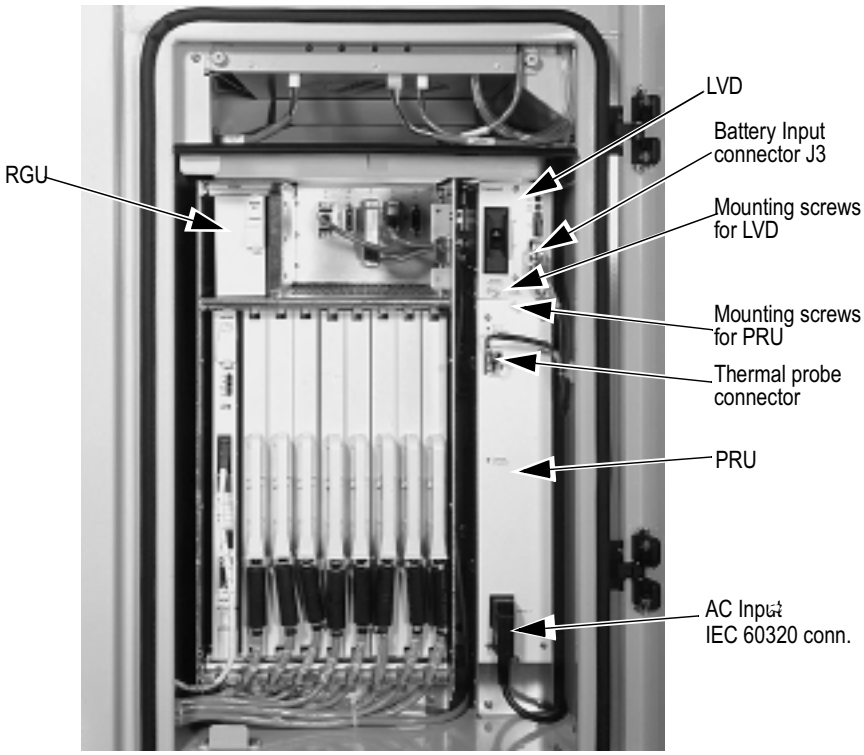


Figure 10-1 ONU with LVD, PRU, and RGU

Table 10-1. Module Codes

Module Designation	Comcode	Apparatus Code
Power rectifier unit 540 W (PRU)	108595844	RS0540, S1:1
Low voltage disconnect unit (LVD)[a]	108784109	LVD500, S2:2
Ringing generator unit (RGU)	108489741	RGU500

a. Can be installed already. Only LVDs with Issue S2:2 or later may be used! Any LVD marked S1:1 for series and vintage should be replaced with the new version marked S2:2 or later.

Installing the PRU

PRU features

The PRU is powered by the AC power supply (93 to 264 V; 47 to 63 Hz) through the IEC 60320 AC power receptacle. The PRU is buffered by four IR-40EC batteries which are connected to the PRU through the LVD.

NOTE:
The PRU must be Issue 1:1, or later, as indicated on the label attached to the PRU. The PRU issue can also determined by the IEC 60320 receptacle on the PRU faceplate (“hot-type” receptacle).

PRU installation procedure

To install the PRU, proceed as follows:

Step 1. Move the AC power supply cord aside so that the empty rectifier shelf inside the ONU is freely accessible.

Step 2. Unpack the PRU and locate the 3-position Margin switch on top, illustrated in Figure 10-2.

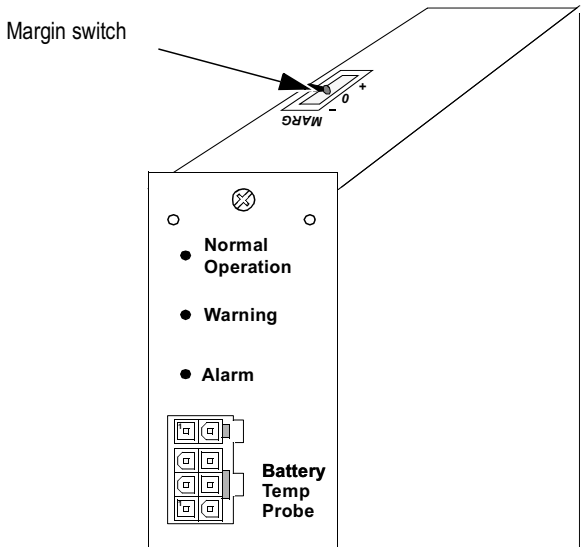


Figure 10-2 Position of the Margin switch

Step 3. Use the 3-position Margin switch to adapt the charging voltage to the appropriate battery type, as indicated in Table 10-2. For the IR-30EC and IR-40EC batteries used in the standard ONU application, adjust the Margin switch to the **“-”** position. If other batteries are used, the engineering work order will specify the required setting.

Table 10-2. Margin switch charging adjustments

Margin switch position	Charging voltage [V][a]	Recommended battery type
MARG position "+"	-54.9 ±0.2 V	-
MARG position "0"[b]	-54.5 ±0.2 V	-
MARG position "-"	-54.1 ±0.2 V	IR-30EC, IR-40EC

a. The voltage is valid for 25°C and if the thermal probe is connected to the PRU. If the thermal probe is not connected, the voltage is fixed in the rectifier to -52.5 V and cannot be changed by the Margin switch.

b. Factory setting as it is delivered.

Step 4. Slide the PRU into the lower position of the rectifier shelf, as shown in Figure 10-1. Push the PRU into the shelf and tighten the two fixing screws on the top and bottom of the faceplate.

Installing the LVD

LVD functions and features

The LVD is designed to connect the 4 IR-40EC batteries to the PRU and is equipped with an automatic disconnect feature that disconnects the batteries when the battery voltage drops below -42.5 V. Figure 10-3 illustrates the position of the controls and indicators on the LVD faceplate.

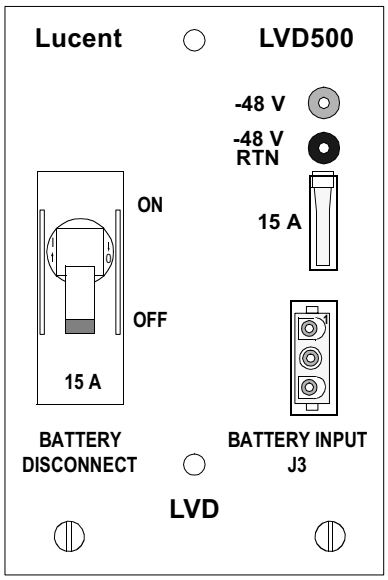


Figure 10-3 LVD Faceplate

The LVD is equipped with test jacks for the -48 V supply. These jacks are connected to the path between the batteries and the battery fuse/circuit breaker. The output voltage of the PRU measured on these jacks will be decreased by the voltage drop caused by the internal protection resistors and the internal resistance of the rectifier equipment. The voltage drop depends on the input resistance of the multimeter used.

LVD installation procedures

To install the LVD, proceed as follows:

Step 1. If the LVD is already installed, switch the battery circuit breaker to OFF, disconnect the battery cable J3 on the LVD, and proceed to Step 4. If the LVD is not installed, continue with Step 2.

Step 2. Unpack the LVD and verify that the battery circuit breaker is switched to OFF. If not, switch to OFF.

Step 3. Slide the LVD into the upper position of the rectifier shelf, as shown in Figure 10-1. Push the LVD into the shelf and tighten the left and right fixing screws on the bottom of the faceplate.

Step 4. Verify that the GMT-type fuse is 15 A. If not, locate the spare 15 A GMT-type fuses (Comcode: 408026243) which have been separately packed and replace the fuse.

WARNING:
Do not connect the battery cable to LVD connector J3. If required, disconnect this cable.

Installing the Optional RGU

RGU functions

To support POTS applications, the ONU shelf must be equipped with the RGU, which is delivered separately. (For ordering see the *AnyMedia® Access System (24 Channel) Ordering Guide*, 363-211-125.) Jumpers can be used to adjust the RGU ringing frequency, as described in the following installation procedure. The factory setting is 20 Hz.

RGU installation procedure

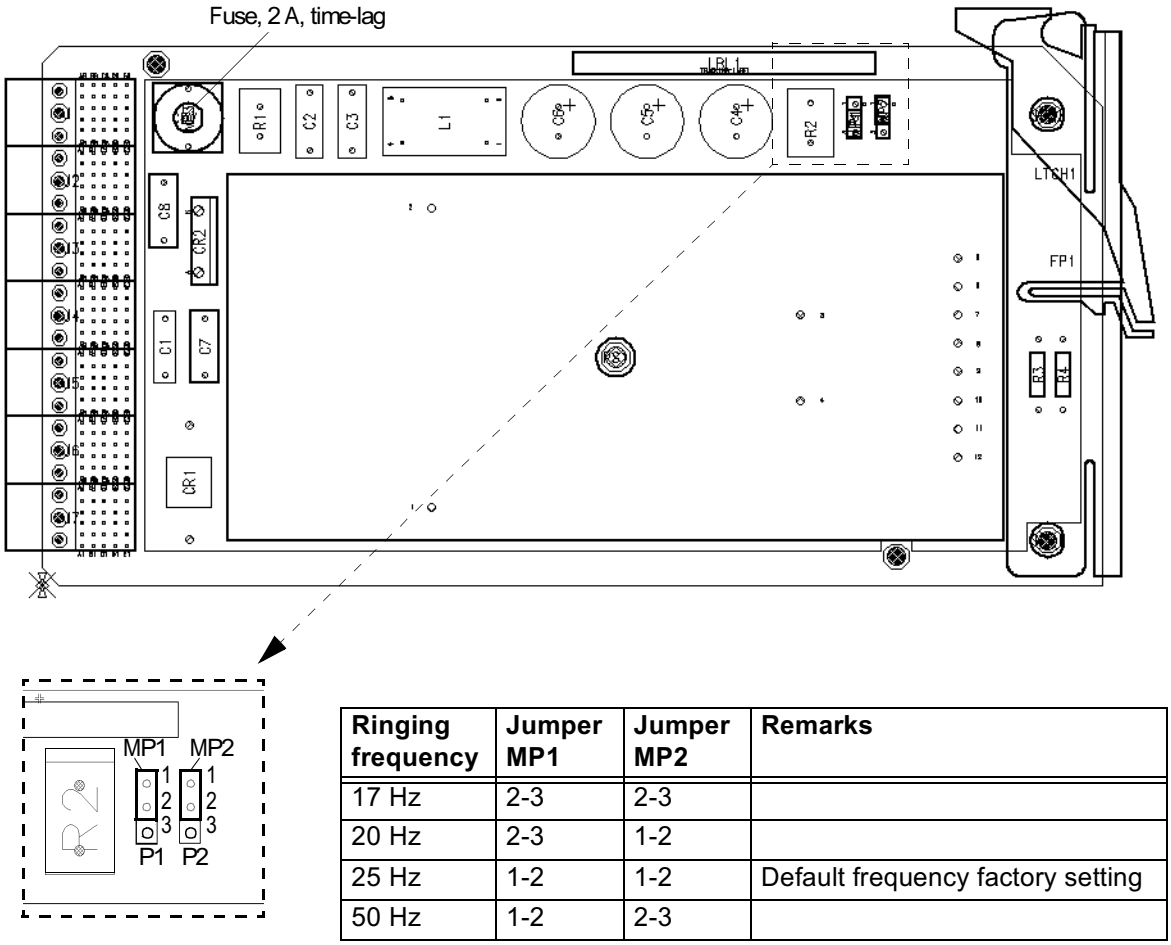
Use the following procedure to install the RGU:

Step 1. Unpack the RGU and verify that the jumpers are set to 20 Hz. Figure 10-4 illustrates the jumper positions that correspond to the available ringing frequencies.

Step 2. Verify that the latch on the RGU is swung out (OPEN position). If it is not, swing the latch upwards about 90 degrees.

Step 3. Slide the RGU into the upper position of the ONU shelf with the printed board to the right, and push the RGU into the shelf. See Figure 10-1 for the RGU shelf position.

Step 4. Lock the RGU in position by pressing firmly on the rounded indentation on the top latch until it clicks into place.



Ringing frequency	Jumper MP1	Jumper MP2	Remarks
17 Hz	2-3	2-3	
20 Hz	2-3	1-2	
25 Hz	1-2	1-2	Default frequency factory setting
50 Hz	1-2	2-3	

Figure 10-4 Location and settings of the jumpers MP1/MP2 on the RGU

Applying AC Power

The AC power supply should be connected to the AC terminal block according to the procedures provided in Connecting to the AC Utility on page 8-4.

To apply AC power, proceed as follows:

Step 1. Be sure that the ONU housing is correctly connected to an approved ground; otherwise, check the grounding continuity (see Checking the Ground Connections on page 6-18).

Step 2. Verify that the AC circuit breaker in the AC breaker panel is switched to OFF

Step 3. For the first power-up, be sure that no packs are inserted in the ONU shelf except the RGU. Temporarily remove any packs that have been inserted.

Step 4. Verify that the battery cable is not connected to connector J3 of the LVD.

Step 5. Ensure that the AC power source is on.

Step 6. Verify in the termination compartment that the short AC power cord is connected to the IEC60320 receptacle near the AC breaker panel.

Step 7. Inside the electronics compartment, locate the AC plug and connect it to the PRU IEC60320 AC power supply receptacle.

Step 8. Switch the AC circuit breaker on the AC breaker panel to ON.

Response: All fan units will turn on, though all LEDs on the cabinet fan unit may not light. The LEDs on the PRU should exhibit the following states:

LED on the PRU	Color	State	Cause
Normal Operation	Green	Extinguished	Batteries not connected
Warning	Yellow	Lights	Thermal probe not connected
Alarm	Red	Lights	Batteries not connected
Thermal Shutdown	Red	Extinguished	Rectifier o.k.

Step 9. Check that the green LED on the AC surge arrestor is lighted; otherwise, the surge arrestor must be replaced.

Step 10. Check visually or by listening that all fans in the fan units work properly. Check the air current above the ONU and above the rectifier shelf. Check the air current of the ambient fan at the upper air outlet on the heat exchanger cover. If the ONU is equipped with the optional battery fan unit, check at the rear of the ONU to verify that the air is introduced on the one fan opening and blown out at the other opening.

Step 11. Connect the thermal probe cable connector to the connector Battery Temp Probe of the PRU.

Response: The LEDs exhibit the following states:

LED on the PRU	Color	State	Cause
Normal Operation	Green	Off	Batteries not connected
Warning	Yellow	Off	Thermal probe connected
Alarm	Red	On	Batteries not connected
Thermal Shutdown	Red	Off	Rectifier o.k.

Checking the Rectifier and Batteries

For the first charging, the batteries and the rectifier should be checked for the correct polarity and charging voltage.

PRU voltage range

If the delivered thermal probe is used and connected (thermistor 10kΩ ± 0.1%), the PRU voltage is temperature compensated with -72 mV/°C in the temperature range from -5°C to +53°C. If the thermal probe is not connected, the rectifier voltage is fixed to about -52.5 V (≙ 53°C). The maximum voltage is limited to about -57 to -58 V. Figure 10-5 illustrates the compensated PRU voltage. The rectifier current is limited to 13 A, as illustrated in Figure 10-6.

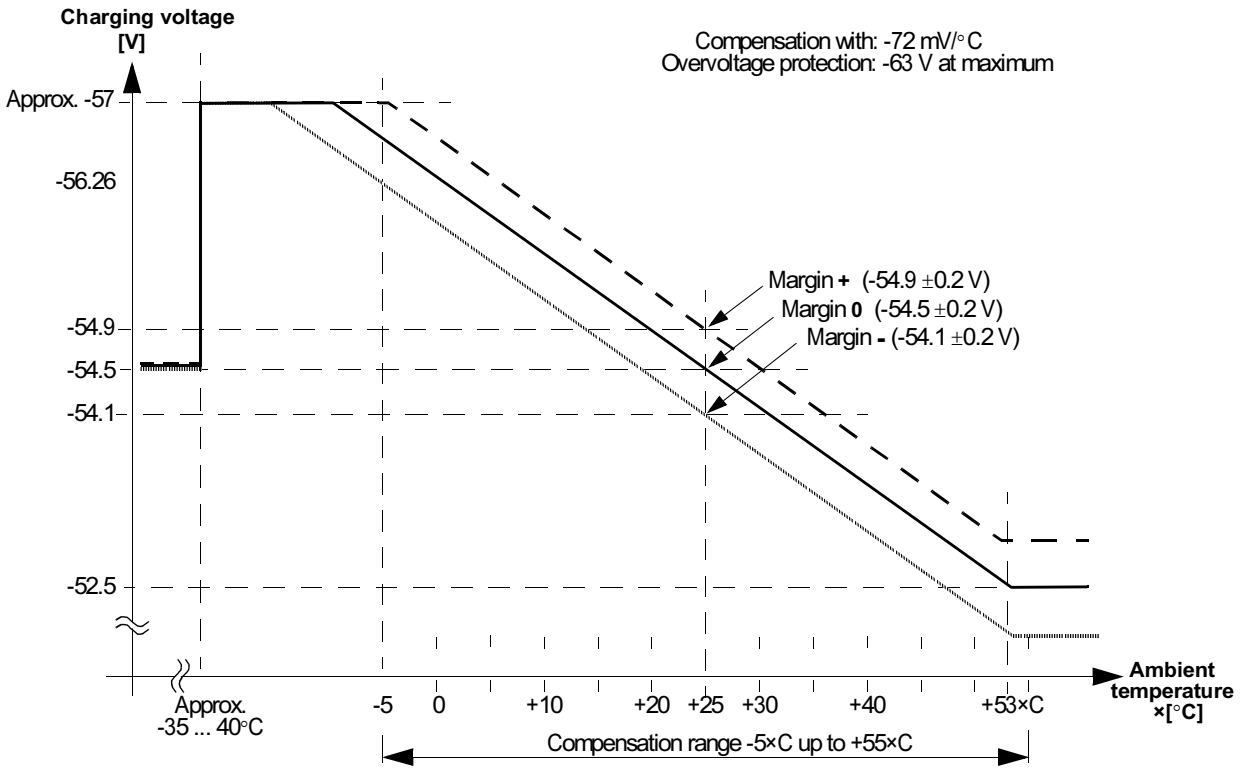


Figure 10-5 Temperature compensation of charging voltage (typical)

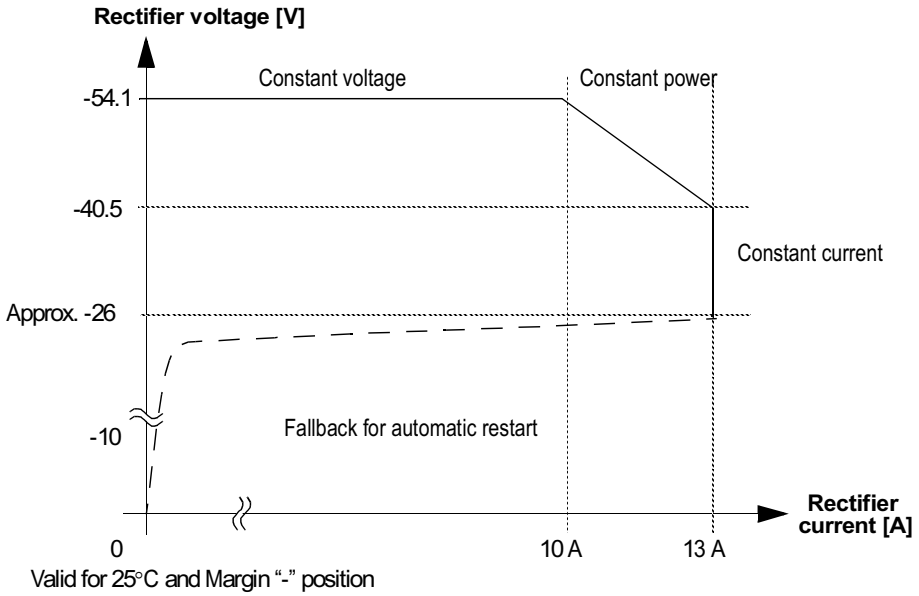


Figure 10-6 Rectifier voltage operation characteristic (typical)

Due to the two 100 kΩ resistors of the test terminals in the LVD, the measured voltage will be about 1 V lower than expected. For the Fluke 8060A multimeter, the voltage drop will be exactly 1 V at 25°C ambient temperature.

Verifying the batteries and rectifier

Use the following procedures to check the batteries and rectifier:

Step 1. Locate in the Installation and Maintenance Record where the battery readings, the installation date and the first readings have already been recorded. (See Appendix A Installation and Maintenance Record.)

Step 2. Verify that the battery cable is not connected to battery Input connector J3 of the LVD.

Step 3. Switch the battery circuit breaker on the LVD to ON.

Step 4. Measure the rectifier voltage on the test terminals on the faceplate of the LVD. Add -1 V (due to the voltage drop caused by the protective resistors) and record in the installation record.

NOTE:
Due to the internal voltage drop in the LVD, the voltage measured on the test terminals will be 1 V lower than the voltage that is applied to the ONU shelf.

Alternatively, you can measure the rectifier voltage at the terminals of battery input connector J3 on the faceplate of the LVD without voltage drop,

but you must take care to avoid short circuiting the rectifier. Figure 10-7 illustrates the wiring of J3.

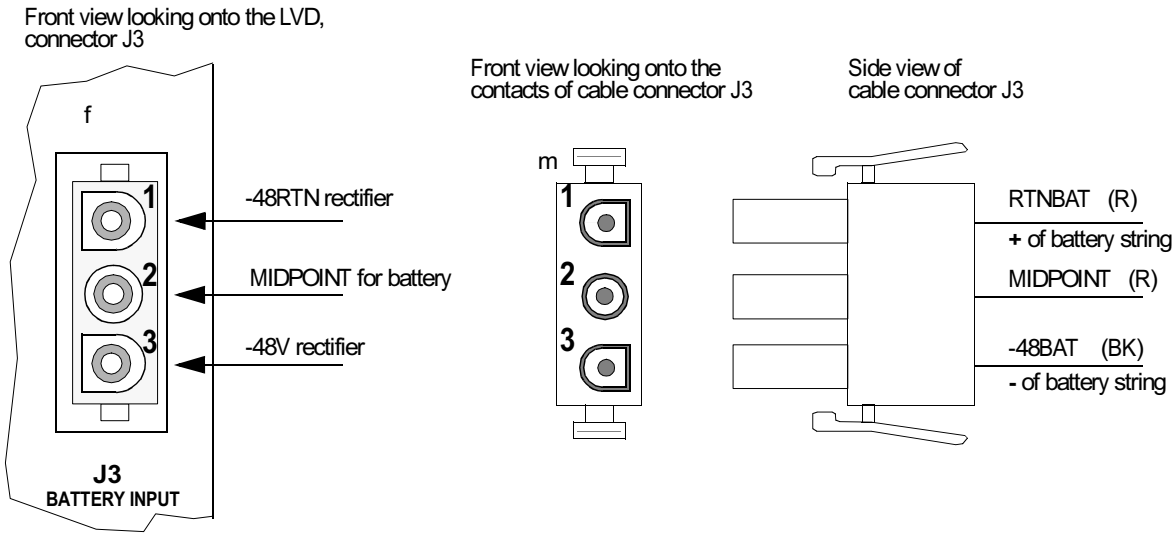


Figure 10-7 Wiring of connector J3 for the LVD and wiring of battery cable connector J3

Step 5. Switch the battery circuit breaker to OFF.

Step 6. Locate the 3-pin battery cable connector J3 and measure the battery string voltage on the outermost connector pins. The outer pin with the black wire is the negative terminal of the battery string. Record the string voltage in the installation record.

NOTE:
Between the middle pin (MIDPOINT) and the outer -48BAT pin (black wire) you will measure the string voltage of batteries 4 and 3; between the middle pin (MIDPOINT) and the outer RTNBAT pin (red wire) you will measure the string voltage of batteries 1 and 2.

Connecting and Charging the Batteries

Battery voltage balance

The PRU is equipped with a supervision circuit that compares the voltage of batteries No. 1 and No. 2 (partial string) with the voltage of batteries No. 3 and No. 4. The allowed difference is 1.7 V maximum. Values greater than 1.7 V will generate a balance failure in the rectifier. If batteries are charged for the first time, this failure can be ignored if the measured battery voltage during battery installation was above 12 V.

Battery specifications

For the input/output specifications and the charging voltage characteristic, see Table 10-3 Input operating specification of the PRU and Table 10-4 Output specification of the PRU.

Table 10-3. Input operating specification of the PRU

Parameter	Value
Input voltage range	100 / 240 V AC
Input frequency range	50 / 60 Hz
Input operating current	7.5 A at 100 V 3.6 A at 240 V
Fusing	Internally fuse protected, not user accessible
	Circuit breaker of a nominal value of 16 A in the ONU AC breaker panel box (interruptive capacity of 5 kA)
EMC	Compliant with EN55022, Class B
Input harmonics	Compliant with EN61000-3-2 A2:1998

Table 10-4. Output specification of the PRU

Parameter	Value
Output voltage with battery temperature sensing probe	-54.5 V ±0.2 V at 25°C (Margin switch set to middle position “0”)
Output voltage without battery temperature sensing probe	Approx. -52.5 V ±0.2 V
Output power	Constant voltage characteristic up to an output current of 10 A (540 W) Constant power characteristic down to -40.5 V (13 A) Constant (limited) current characteristic down to -26 V
Load current sharing	Parallel or n+1 redundant operation with active load sharing
Ripple and noise	Less than 75 mV_{rms} (or 200 mV_{p-p} (DC to 20 MHz)) when connected to a 48-V battery string of 36 mΩ nominal impedance
Overvoltage protection	Output will not exceed -63 V

Procedure for connecting and charging the batteries

Follow these procedures to connect and charge the batteries:

Step 1. Verify that the battery circuit breaker on the LVD is switched to OFF.

CAUTION:
Before you connect the batteries, switch the battery circuit breaker OFF. If the batteries are connected to a working rectifier, the charging current can be about 13 A, which can cause arcing. When connecting the batteries to a working rectifier, the allowed difference between the battery and rectifier voltage must be below 0.05 V.

Step 2. Connect the battery cable to battery Input connector J3 of the LVD.

Step 3. Switch ON the battery circuit breaker on the LVD.

Response: The LEDs indicate the following states:

LED on the PRU	Color	State	Cause
Normal Operation	Green	Lights	Batteries connected
Warning	Yellow	Extinguished	Thermal probe connected
Alarm	Red[a]	Lights or extinguished	Battery balance failure[b] or batteries and rectifier o.k
Thermal Shutdown	Red	Extinguished	Rectifier o.k.

a. Flashes at overload.

b. If batteries are charged for the first time this failure can be ignored for the first 48 hours.

Step 4. Record the charging date in the installation record.

Step 5. Charge the batteries for at least 48 hours without interruption.

Step 6. After 48 hours, switch “OFF” the battery circuit breaker on the LVD and locate the battery cable connector J3 inserted in J3 of the LVD.

Step 7. Disconnect J3 to measure the open circuit battery string voltage.

Step 8. Measure the string voltage on the outermost pins of the battery cable connector J3 and record in the installation record. See Figure 10-7 for the wiring of J3.

NOTE:
The measured voltage must be at least -51.2 Volts. Due to the inner voltage drop in the LVD, the battery voltage measured on the test terminals will be 1 V lower than the actual battery string voltage.

NOTE:
The first charging should not be interrupted, and the batteries should be charged fully before discharging them on a working ONU.

Step 9. Connect the battery cable connector J3 to the LVD.

Step 10. Switch the battery circuit breaker to “ON”.

NOTE:
It is recommended that you leave the batteries connected to the rectifier.

Fan Unit and Battery Maintenance

11

Overview

This chapter covers the recommended maintenance procedures for the *AnyMedia* ONU fan units and batteries.

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Maintenance Intervals

Fan units

Depending on the working conditions, check the fan for replacement after 40,000 working hours (about 4 years and 7 months if working 24 hours a day). If a cabinet or heat exchanger fan alarm occurs attend to the fan units and service them immediately. Replace defective fan units without delay.

Screens and heat exchanger ducts

Check the fan screens and the ducts of the heat exchanger to determine if they need to be cleaned about 2 months after the initial installation and every 6 months thereafter.

If the high temperature alarm occurs, immediately attend to the heat exchanger and the heat exchanger fan. This procedure should only be performed when the ambient temperature is below +131° F (55° C).

Batteries

The batteries must be maintained quarterly and the Installation and Maintenance Record must be filled out and signed. The Installation and Maintenance Record is used to record measurable parameters during maintenance work, and the completed forms will be required for any future warranty claims. IR-40EC batteries have a guaranteed lifetime of 5 years and should be replaced after that interval to ensure reliable performance. Replace the batteries sooner if the ambient temperature is consistently above 77° F (25°C).

NOTE:
Operating the IR-40EC battery for any length of time above 77° F (25°C) will result in reduced performance and premature failure. Operation or storage for a significant interval of time above 122° F (50°C) may reduce or void the product warranty.

Maintenance of the Fan Units

The initial maintenance interval for the fan units, fan screens and ducts of the heat exchanger is 2 months after the initial installation. Afterward, check them every 6 months (or less if the ONU is being operated in a harsh environment).

Cleaning the fan screens

There are fan screens on the two vents of the optional battery fan unit (on the back of the ONU) and on the vent of the heat exchanger (on the right side of the ONU).

Open the front door of the ONU cabinet and use a vacuum cleaner to clean the fan screens. For vacuum cleaning, the cleaning airflow must be reverse to the operational airflow.

Cleaning the heat exchanger

If the intake and/or exhaust of the heat exchanger become blocked with debris, an alarm LED will illuminate. Otherwise, the frequency of cleaning should be determined by the operating environment.

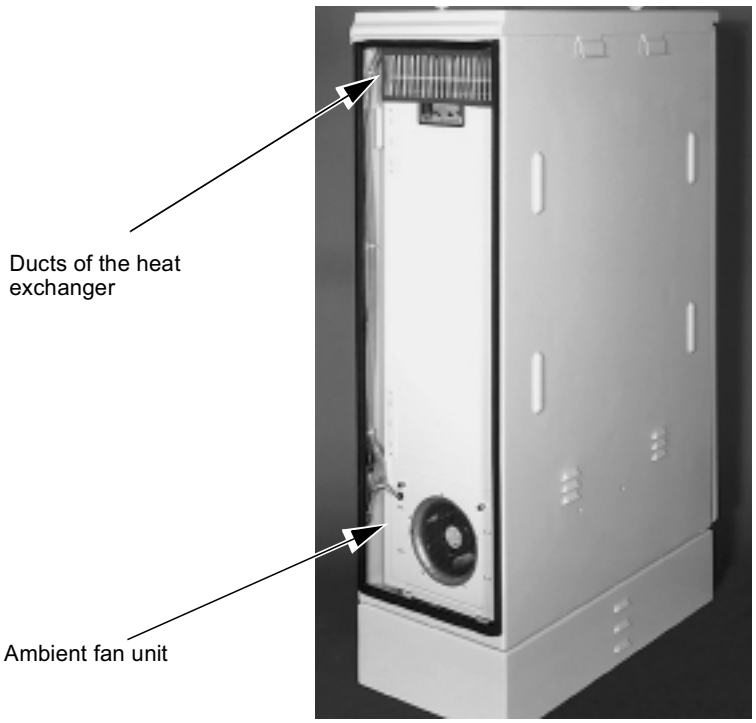

Figure 11-1 Heat exchanger side of the ONU

Use the following procedure to clean the ducts and the heat exchanger itself.

WARNING:
The heat exchanger cover could fall after it is unlocked and cause injury. Hold the cover securely while you are unlocking it.

Step 1. Unlock the cover of the heat exchanger compartment on the right side of the outdoor ONU and remove the cover temporarily to a safe place.

Step 2. Determine if the blockage is within the screen/vent contained in the temporarily removed cover and/or within the ducts of the heat exchanger. Clean both areas as needed.

Step 3. A vacuum cleaner or a water hose can be used to clean the fan screen in the temporarily removed cover.

Step 4. If there is no blockage inside the ducts of the heat exchanger, proceed to Step 11.

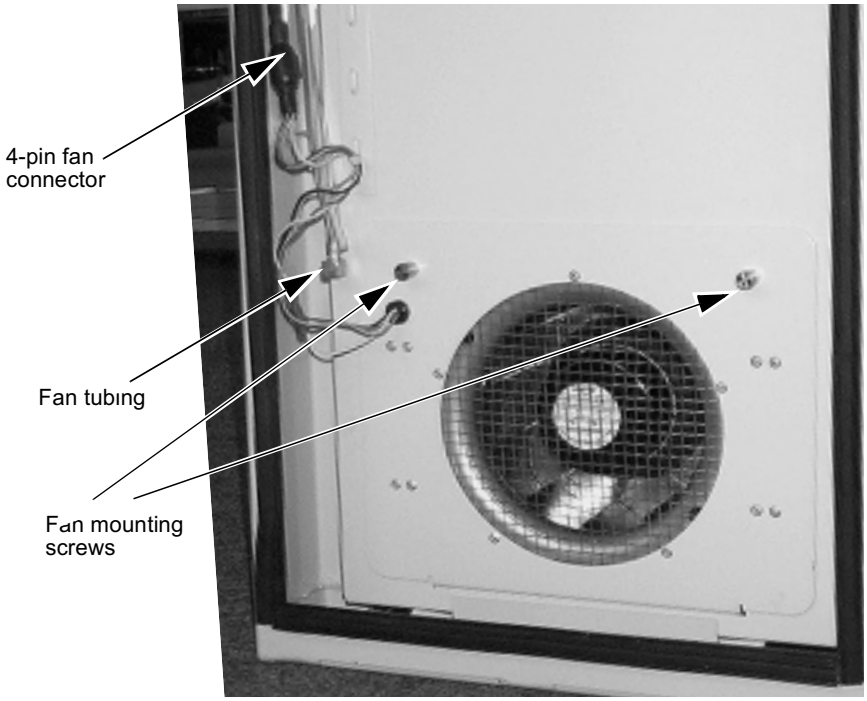

Figure 11-2 Ambient fan mounting points

Step 5. Disconnect the 4-pin fan cable connection in the lower left of the compartment.

Step 6. Disconnect the tubing to the fan unit, which is also located in the lower left of the compartment.

Step 7. Using a standard screwdriver, loosen the captive screws holding the ambient fan unit in place.

Step 8. Remove the ambient fan unit by loosening the fasteners completely and tilt the unit out until it clears the heat exchanger.

Step 9. If required, clean the ambient fan unit with a vacuum cleaner and/or with a paintbrush.

Step 10. A standard water hose can be used to remove any accumulated debris inside the ducts of the heat exchanger.

NOTE:
Do not use a tool of any kind within the ducts of the heat exchanger to remove debris, as this may cause a puncture in the thin copper wall tubing.

Step 11. Install the ambient fan unit in the same manner as it was removed, by setting the bottom tabs first and tilting the unit up until the captive screws can be engaged.

Step 12. Tighten the two fasteners with the screwdriver.

Step 13. Connect the tubing to the fitting on the fan unit.

Step 14. Connect the 4-pin fan cable connection disconnected in Step 5.

Step 15. Verify that the alarm signal on the cabinet fan unit has extinguished.

Step 16. Reinstall the heat exchanger cover.

Fan inspection

During inspection of the vents and/or fan screens check the optional battery fans and the ambient fan of the heat exchanger for debris.

Procedure for replacing the ambient fan

An alarm LED will illuminate if a fan fails within the heat exchanger unit. If the ambient fan unit is defective, it must be replaced immediately. To ensure reliable cooling, replace the ambient fan unit after 40,000 working hours

Use the following procedure to remove and replace the fan unit without service interruption:

Step 1. Unlock the heat exchanger cover of the heat exchanger compartment on the right side of the ONU and remove the cover temporarily to a safe place.

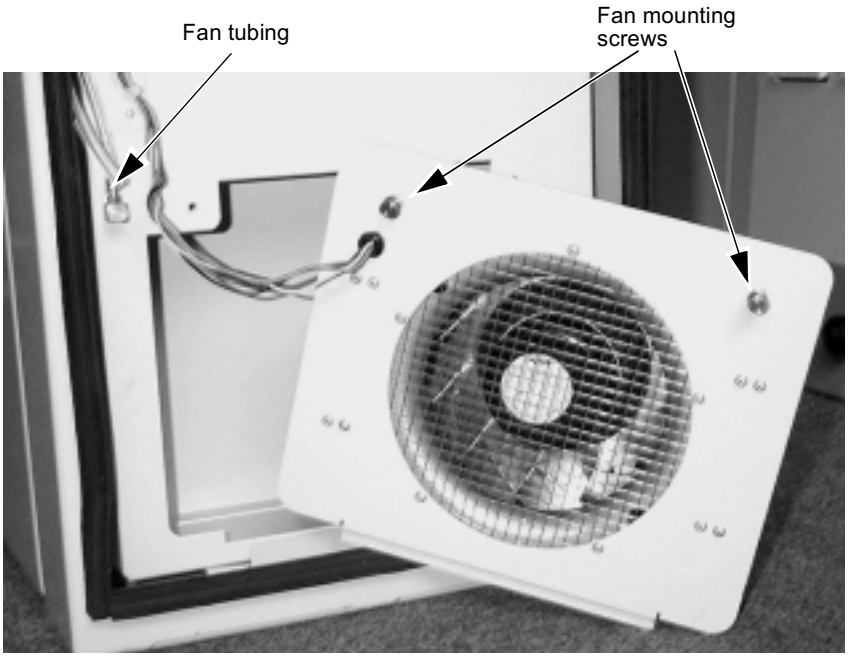

Figure 11-3 Ambient fan removed

Step 2. Disconnect the 4-pin fan cable connection in the lower left of the compartment.

Step 3. Disconnect the tubing to the fan unit also located in the lower left of the compartment.

Step 4. Using a standard screwdriver, loosen the captive screws holding the ambient fan unit in place.

Step 5. Remove the ambient fan unit by loosening the fasteners completely and tilt the unit out until it clears the heat exchanger.

Step 6. Unpack the replacement fan unit with the Comcode 848539235.

Step 7. Verify that the model number is the same as the unit removed.

Step 8. Install the new ambient fan unit in the same manner as it was removed, by setting the bottom tabs first and tilting the unit up until the captive screws can be engaged.

Step 9. Tighten the two fasteners with the screwdriver.

Step 10. Connect the tubing to the fitting on the fan unit.

Step 11. Connect the 4-pin fan cable connection disconnected in Step 2.

Step 12. Verify that the alarm signal on the cabinet fan unit has gone out.

Step 13. Reinstall the heat exchanger cover.

Procedure for replacing the cabinet fan unit

An alarm LED will illuminate if a cabinet fan fails. Use the following procedure to remove and replace the cabinet fan unit without service interruption.

Step 1. Open the front door of the cabinet.

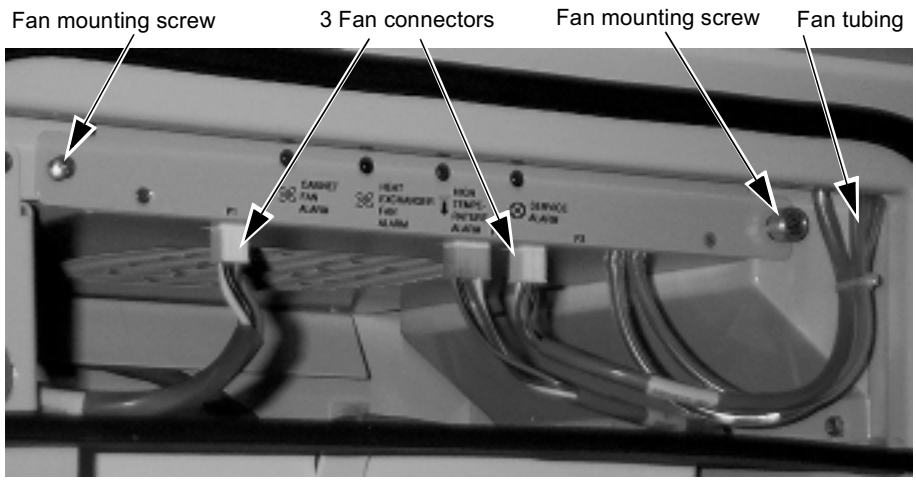

Figure 11-4 Cabinet fan unit

Step 2. Locate the cabinet fan at the top of the cabinet and disconnect/break all four connections on the underside of the unit including the:
- three power connections to the cabinet fan
- ambient fan
- battery fan
- tubing for measuring pressure differential within the heat exchanger compartment

Step 3. Using a standard screwdriver, loosen the captive screws until the fan unit can be pulled forward slightly and lowered.

Step 4. Carefully remove the fan unit from the cabinet.

Step 5. Unpack the replacement fan unit with the Comcode 848539219.

Step 6. Verify that the model number is the same as the unit removed.

Step 7. Install the new fan unit in the same manner as it was removed, by setting the rear of the unit on the bracket in the back of the cabinet. Lift the unit up and push backwards until the captive screws can be engaged.

Step 8. Tighten the two fasteners with the screwdriver.

Step 9. Connect the tubing to the fittings on the fan unit.

Step 10. Connect the three power cables to the new cabinet fan unit.

Step 11. Verify that the alarm signal on the cabinet fan unit has gone out.

Step 12. Close the front door of the cabinet.

Procedure for replacing the battery fan unit

An alarm LED will illuminate if a battery fan unit fails. Use the following procedure to remove and replace the battery fan unit without service interruption.

Step 1. Open the front door of the cabinet.

Step 2. On the low voltage disconnect unit (LVD) in the upper part of the rectifier shelf ensure that the battery circuit breaker is switched "OFF." For the location of the LVD and the other parts see Installing the Power and Ringing Modules on page 10-3.

Step 3. Disconnect the battery connector J3 on the LVD temporarily.

Step 4. Loosen the wing nut above the battery hold down bracket and remove the bracket.

Step 5. Disconnect all four IR-40EC batteries from the battery string cable.

Step 6. Remove the ring lug thermistor probe of the temperature compensation cable from the casing of the battery.

Step 7. Remove the batteries temporarily in reverse order as they are numbered: 4, 3, 2, 1. Temporarily remove the long threaded rod.

NOTE:
Do not grip the rod at the top. Grip it only by the middle or lower portion.

Step 8. Disconnect the power connection J2 to the battery fan unit in the middle of the fan controller board.

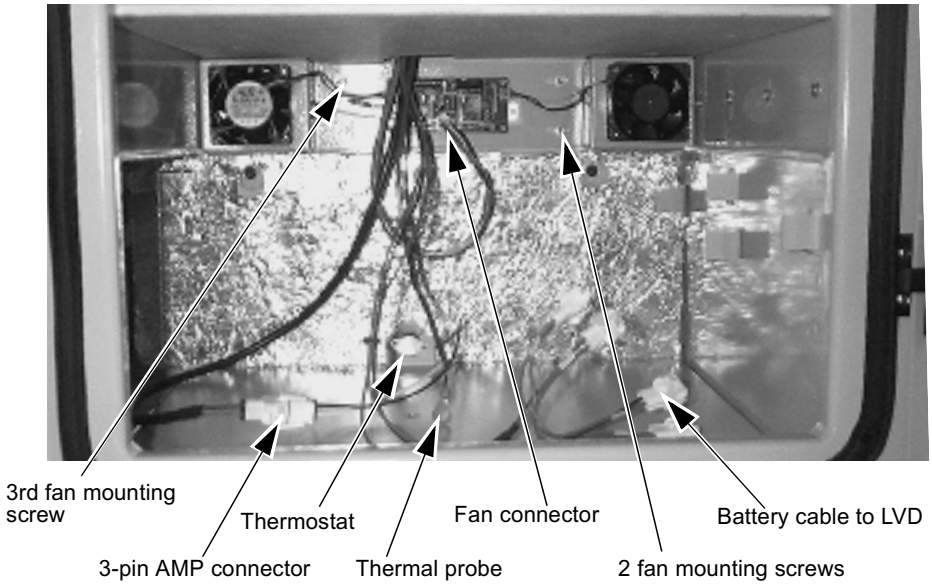

Figure 11-5 Battery fan unit and battery compartment

Step 9. Loosen and remove the three hex nuts securing the battery fan unit.

Step 10. Carefully remove the battery fan unit from the compartment.

Step 11. Re-install the replacement fan unit and secure with the same fasteners.

Step 12. Re-connect the fan cable disconnected in Step 8. to the battery fan unit.

NOTE:
Reinstall the batteries in the opposite order that they were removed.

Step 13. Position the first battery (No. 1) with its terminals facing to the front in the rear left corner of the battery compartment, as shown in Figure 11-6. Move the 2-pin battery assembly to the right.

Step 14. Locate the battery cable and the thermal probe cable and move them out of the way.

Step 15. Repeat Step 13. with the second battery (No. 2) and position it in the rear right corner of the ONU. Move the 2-pin battery assembly to the left.

Step 16. Screw in the temporarily removed long threaded rod.

Step 17. Repeat Step 13. with batteries No. 3 and No. 4 as shown in Figure 11-6.

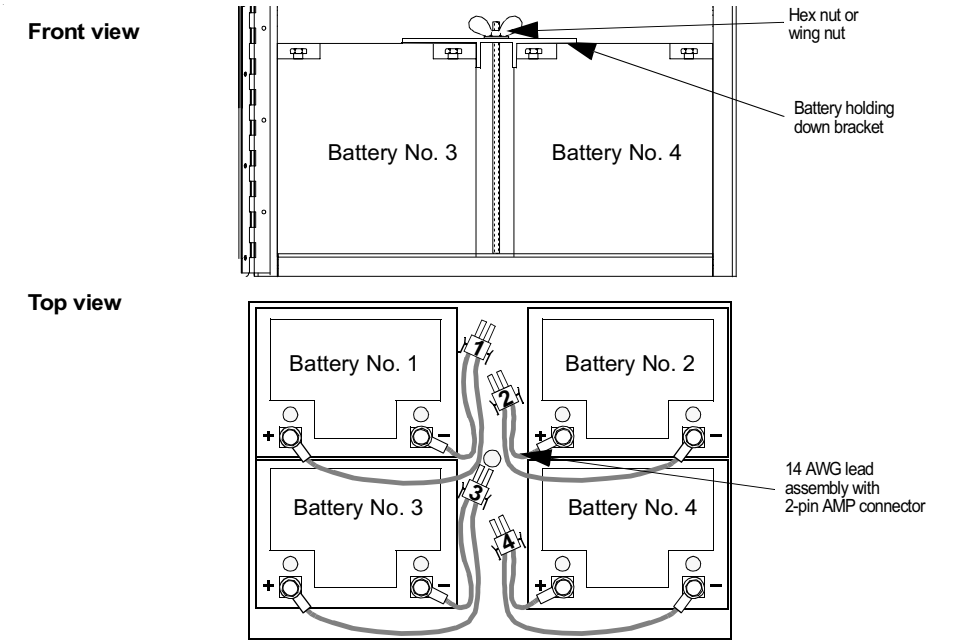

Figure 11-6 Battery arrangement

Step 18. Move batteries No. 1 and No. 3 and batteries No. 2 and No. 4 close to each other and move them to the side walls of the housing.

Step 19. Connect the polarized 2-pin plugs of the batteries to the appropriate connectors of the battery cable and arrange the battery cabling in the free space between the batteries.

Step 20. Inside the battery compartment locate the thermal probe (which looks like a cable with ring type terminal) and insert the terminal between the metallic case and the battery housing of battery No. 3 as shown in Figure 11-7.

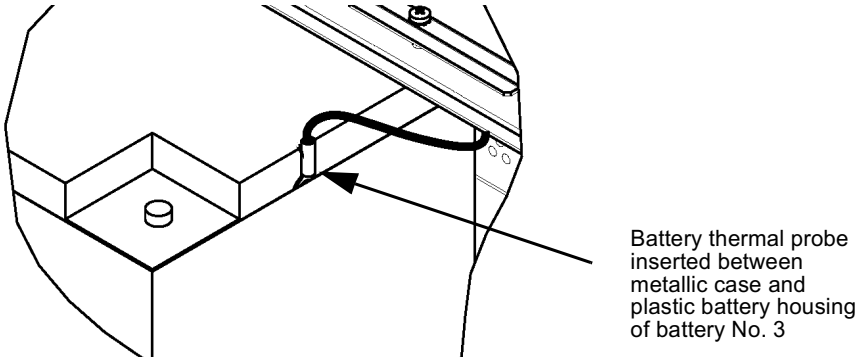

Figure 11-7 Position of the ring-type thermal probe

Step 21. Install the battery hold down bracket and tighten the wing nut securely as shown in Figure 11-8.

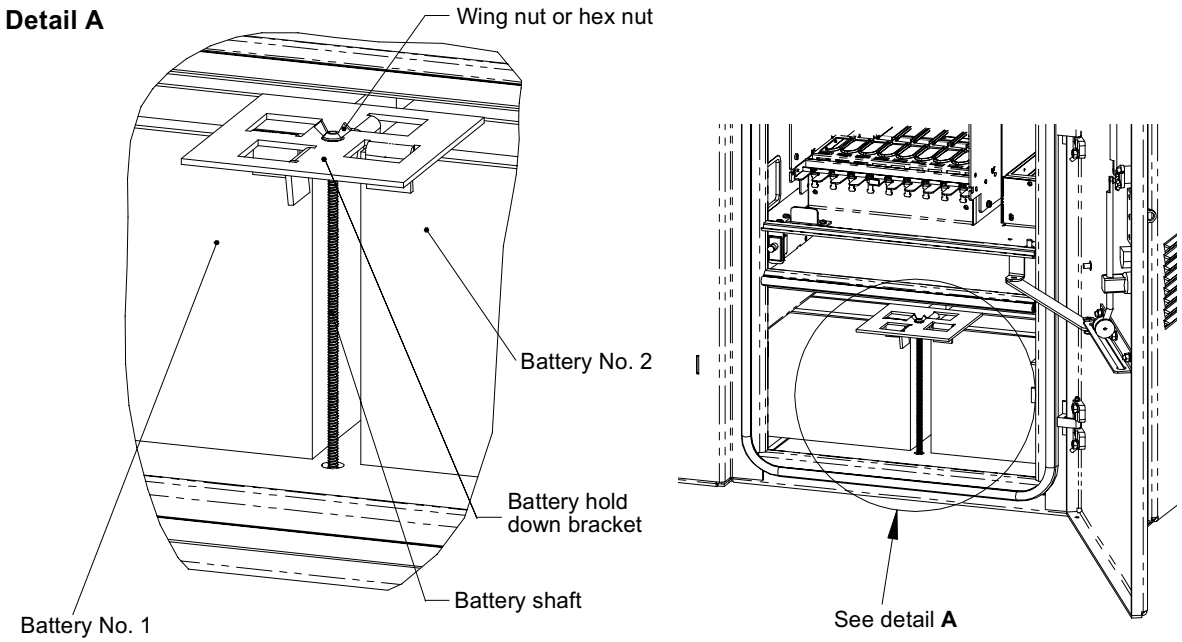

Figure 11-8 Mounted batteries (batteries No. 1 and No. 2 already inserted, batteries No. 4 and No. 5 have to be inserted)

Step 22. Reconnect the battery connector J3 on the LVD and switch the battery circuit breaker on the LVD to ON.

Response: The LEDs exhibit the following states:

LED on the PRU	Color	State	Cause
Normal Operation	Green	Lights	Batteries connected
Warning	Yellow	Extinguished	Thermal probe connected
Alarm	Red[a]	Lights or extinguished	Battery balance failure[b]
		Extinguished	Batteries and rectifier o.k.
Thermal Shutdown	Red	Extinguished	Rectifier o.k.

a. Flashes at overload.

b. If batteries are charged for the first time this failure can be ignored for the first 48 hours.

Step 23. Verify that there are illuminated red alarm LEDs on the power rectifier unit.

Step 24. Close the front door of the cabinet.

Battery Maintenance Practice

Battery safety

For safe battery handling, always take the following basic precautions:

- Use only properly insulated tools and test equipment.
- Remove all metallic objects (key chains, glasses, rings, watches, or any other jewelry).
- Wear safety glasses.
- Test circuits before touching.
- Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn-on.
- Be aware of potential hazards before servicing equipment.
- Identify exposed hazardous electrical voltages on connectors, wiring, etc. (Note the condition of these circuits, especially any wiring.)
- Take care when removing or replacing any covers. Avoid contacting any circuits.
- For cleaning batteries use a damp soft cloth only. Do not use solvents, paraffin, abrasive or proprietary cleaning fluids.

DANGER:
A battery short circuit will cause destruction by arcing of batteries and cables and thus malfunctioning of the complete system.

Be aware of potential hazards before servicing battery equipment.

You must always use properly insulated tools and test equipment for installing and connecting batteries.

When working on batteries always wear splash-proof safety goggles, acid-resistant gloves, rubber overshoes and an apron.

While maintaining the batteries, you must:

- **Never** place metal objects (including tools) on top of a battery.
- **Never** short out the battery terminals.
- **Never** use an open flame near batteries.

Gas explosion

All lead-acid batteries generate hydrogen gas, even under open circuit conditions. If not permitted to escape, this gas can build up to explosive concentrations.

NOTE:
Mechanical power switches and electrostatic voltages are sources of spark gaps!

An explosion can occur when sparks are created near the battery string. To avoid sparks, check that the batteries are not charging or discharging before loosening or removing battery connections. Provide adequate ventilation.

GMT fuses

The GMT-type fuses in the low voltage disconnect unit (LVD) can produce sparks during interruption or clearing of a fault on a high energy circuit. Use only GMT fuses specified by Lucent Technologies.

Battery connections

To avoid loose connections, take care to avoid stripping the bolt and/or nut threads by overtightening the inter-battery connectors.

Electrolyte contact

In the event of electrolyte contact with the skin, remove the electrolyte immediately by rinsing the affected area with large amounts of plain tap water. In the event of electrolyte contact with an eye, allow at least one liter of water to run over the eye and under the eyelid. Eye injuries should be treated by a physician immediately.

Acid spills

If large acid spill occurs, use agricultural or industrial lime instead of soda to neutralize the acid before cleanup. If lime is not available, you may use baking soda. Wear eye protection devices and rubber gloves when using lime on electrolyte spills. Sprinkle the lime on the spillage; allow it to absorb the electrolyte, and then sweep it up and dispose of it safely, according to local regulations. Wash hands and face thoroughly after cleanup.

Battery Maintenance Procedures

Maintenance routines

The battery maintenance routines are classified into two categories:

- Required (Table 11-1.)
- Suggested (Table 11-2).

Always follow the battery manufacturer's recommended maintenance schedules procedures, which supersede the instructions provided in this chapter.

NOTE:
Failure to adhere to these maintenance schedules will void the warranty for IR-40EC batteries.

NOTE:
Battery maintenance procedures can interrupt the battery buffering for the ONU shelf and cause a shut-down of the complete ONU.

Maintenance intervals for IR-40EC batteries

Use the manufacturer's installation and maintenance record forms or the copies of the Installation and Maintenance Record provided in Appendix A.

Maintenance intervals

The following maintenance intervals are mandatory for IR-40EC batteries.

Table 11-1. Required maintenance intervals for IR-40EC batteries

Routine	Action	Interval
Battery string voltage	Measure / record	Quarterly
Battery voltage	Measure / record	Quarterly
Inter-battery connections	Inspect	Quarterly
	Clean (if necessary)	As needed
Inter-battery connections	Retorque if the 14 AWG lead has been replaced	As needed
Battery string current	Measure / record	Optional or quarterly depending on the Maintenance Record used
Battery temperature	Measure / record	
External charging	Charge only if required / record	

Table 11-2. Suggested maintenance routines (additional)

Routine	Action	Interval
Discharge test	Measure / record	Optional

Required tools

Tools

You will need the following tools and materials to install and test the battery string:

- Splash-proof safety goggles, acid-resistant gloves, rubber overshoes and apron
- Cleaning cloth
- Lime and/or soda (sodium bicarbonate)
- Insulated socket drive or nut driver set (1/4-inch through 3/4-inch sockets) and torque wrench (0 to 60 in-lbs, 6 Nm) for maintenance/replacement
- Sandpaper or abrasive cloth (for cleaning the battery compartment only)
- DMM (Digital Multimeter), Tek DM254 or *Fluke* 8060A or equivalent. (The accuracy of an equivalent meter should be 0.05 percent on the DC scale.)
- Current converter/transformer or current probe 1:10 for multimeter usable up to 20 A.
- Thermometers for measuring the ambient and battery temperature (contact type)

A Class C fire extinguisher should be reachable.

Battery String Float Voltage

Determining the float voltage

To ensure safe and efficient battery operation, always maintain the battery at the proper float voltage, which is determined as follows:

Battery string voltage = recommended float voltage per battery × number of batteries.

The float voltage required is ambient temperature dependent. The PRU will adapt this charging voltage with -72 mV/°C, as illustrated in Figure 10-5 on page 10-13. The recommended float voltage per IR-40EC battery is 13.5 V ±0.06 V at a battery temperature of 77°F (25°C).

For example, a 4-battery string of IR-40EC batteries should be floated at:

Battery string voltage = 13.5 V × 4 batteries = 54.0 V ±0.24 V

NOTE:
The required charging voltage is different for other battery types. Always use the values provided by the battery manufacturer).

Measuring the voltage of the battery string

Read battery string voltages periodically to ensure that they are floating properly. A Fluke 8060A DMM (digital multimeter) is suitable for battery voltage readings. The accuracy of an equivalent meter should be 0.05 percent on the DC scale. Check the meter periodically for accuracy and calibration.

You may use either of the following methods to measure the string voltage on the battery cable connector J3:

- Measure on the wiring side of the battery cable connector J3 plugged in the LVD by inserting the probes into the opening for the wires using small test probes
- Measure on the contact side of the battery cable connector J3 disconnected from the LVD by inserting the probes into the contacts.

CAUTION:
Be aware that maintenance actions will interrupt the battery buffering for the ONU Shelf if the battery circuit breaker is switched OFF and J3 is disconnected. A loss of AC power during these maintenance procedures will cause a shut-down of the complete ONU.

CAUTION:
Observe the following precautions to avoid short circuits during battery maintenance procedures:

- Use insulated probes for measuring.
- Be very careful when taking voltage readings to prevent accidental grounding or shorting of leads during measuring operations.
- Connections at the meter must be secure and free of any possibility of touching or becoming grounded.
- Never remove connections at the meter end without first disconnecting the test leads from the battery.
- Remove test lead connections at the battery immediately after each reading is taken.

Battery string measurement procedure

Use the following procedure to measure the battery string voltage:

Step 1. Locate the Installation and Maintenance Record where the battery readings, the installation date and the first readings have been recorded. Verify that the batteries have been on continuous, uninterrupted float for at least 48 hours.

Step 2. Switch the battery circuit breaker to OFF.

Step 3. Locate and disconnect the 3-pin battery cable connector J3. The wiring for connector J3 is illustrated in Figure 11-9.

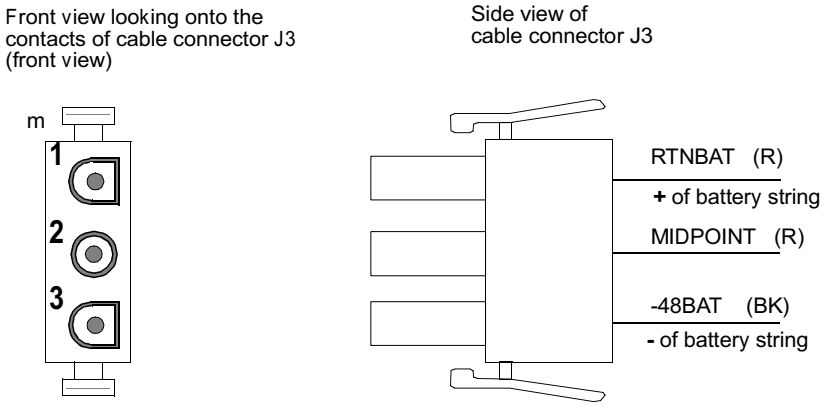

Figure 11-9 Wiring of battery cable connector J3

WARNING:
The battery cabling is not fuse protected for the battery interconnections up to the battery circuit breaker. When taking voltage readings, a short

in this area can cause an arc that will destroy batteries and cables, leading to malfunctioning of the complete ONU.

Step 4. Measure the battery string voltage on the outermost connector pins. The outer pin with the black wire is the negative terminal of the battery string.

Measure the string voltage of batteries 4 and 3 between the middle pin and the outer "-" pin (black wire).

Measure the string voltage of batteries 1 and 2 between the middle pin and the outer "+" pin (red wire).

Requirement: The string voltage must be at least: 51.2 V.

Step 5. Record the string voltage in the Installation and Maintenance Record.

You can also measure the string voltage without interrupting the buffering by measuring on the wiring side of the battery cable connector J3 plugged in the LVD by inserting the probes into the opening for the wires using small test probes.

Measuring the voltage of a single battery

Measure the individual battery voltages periodically to ensure that they are floating properly. Readings for each battery must be within ±0.18 V of the string average (calculated by dividing the string voltage by the number of batteries in the string).

Additionally the power rectifier unit is equipped with a supervision component that compares the voltage of batteries 1 and 2 (1st partial string) to the voltage of batteries 3 and 4 (2nd partial string).

To measure battery voltage, the battery string must be disconnected from the rectifier.

CAUTION:
Be aware that maintenance actions will interrupt the battery buffering for the ONU Shelf if the battery circuit breaker is switched OFF and J3 is disconnected. A loss of AC power during these maintenance procedures will cause a shut-down of the complete ONU.

CAUTION:
Observe the following precautions to avoid short circuits during battery maintenance procedures:

- Use insulated probes for measuring.
- Be very careful when taking voltage readings to prevent accidental grounding or shorting of leads during measuring operations.
- Connections at the meter must be secure and free of any possibility of touching or becoming grounded.
- Never remove connections at the meter end without first disconnecting the test leads from the battery.
- Remove test lead connections at the battery immediately after each reading is taken.

Individual battery measurement procedure

Use the following procedure to measure the voltage of an individual battery:

Step 1. Locate the Installation and Maintenance Record in which the battery readings, the installation date and the first readings have been recorded. (See Appendix A Installation and Maintenance Record) Verify that the batteries have been on continuous, uninterrupted float for at least 48 hours.

Step 2. Switch the battery circuit breaker to OFF.

Step 3. Locate and disconnect 2-pin battery connectors Batt1 through Batt4 in the battery compartment. The wiring for the 2-pin battery connector is illustrated in Figure 11-10.

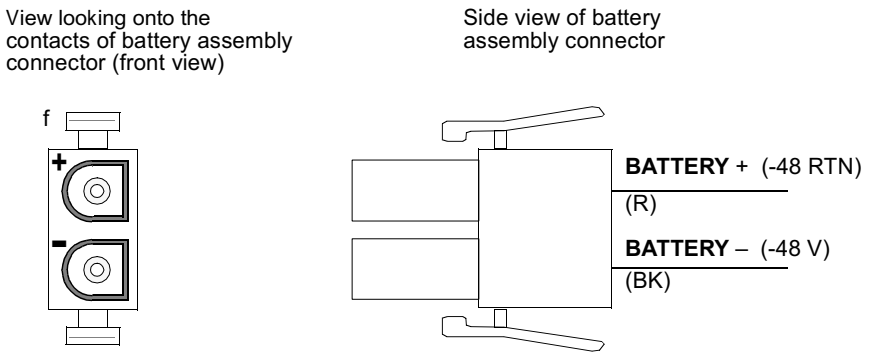

Figure 11-10 Wiring of the 14 AWG lead battery assembly connectors

WARNING:
The battery cabling is not fuse protected for the battery interconnections up to the battery circuit breaker. When taking voltage readings, a short in this area can cause an arc that will destroy batteries and cables, leading to malfunctioning of the complete ONU.

Step 4. Measure the battery voltage for each battery on the 2-pin 14 AWG lead assembly connector and record the battery voltage in the Installation and Maintenance Record.

Because float readings are affected by discharges and recharges, these readings must be taken when the batteries have been on continuous, uninterrupted float for at least *one week*.

NOTE:
Any fully charged IR-40EC battery at float that reads less than 13 V at 77°F (25°C) is considered to be shorted and must be replaced*. For battery replacement procedures, see Battery Replacement on page 11-25.

Step 5. Connect the battery connectors Batt1 to Batt4.

Step 6. Switch the battery circuit breaker on the LVD to ON.

* For the IR-40EC batteries it is recommended to replace all 4 batteries if the batteries are older than about 1 to 2 years.

Battery Compartment Maintenance

Cleaning and inspecting

Inspect the batteries and the battery compartment visually at least twice a year (or more often, if warranted). If necessary, clean the batteries and the battery compartment using a soft cloth dampened in water. Inspect the delivered battery cable assemblies for corrosion. Report any sign of acid or corrosion to Tyco.

Acid spills and corrosion

In acid spills occur, clean the battery compartment properly. A wire brush may be used to clean acid spills in the battery compartment. Any damaged areas must be re-varnished.

WARNING:
When cleaning the metal battery compartment with a wire brush, do not let it come in contact with the battery terminals or inter-battery connectors, which can short circuit the batteries and cause considerable damage.

Retorquing inter-battery connections

The inter-battery connections for the battery cable assemblies are factory delivered. You will only need to retorque these connections when you are replacing the batteries or the cable assembly.

NOTE:
The battery is equipped with 10-32 x 0.50 screws. *Do not* use M5 screws as replacements for the original screws.

If retorquing is required retorque IR-40EC batteries with:

40 ±10 inch-pounds (about 4.4 Nm) for IR-40EC batteries.

CAUTION:
Overtightening of the inter-battery connectors could strip the bolt and/or nut threads resulting in loose connections.

Ensure that all battery connections are tight with the exception of the connection that is being opened.

For retorquing use an insulated torque wrench. Use the torque values specified by the battery manufacturer.

CAUTION:
An explosion could occur if sparks are created near the battery string.

Check that the batteries are not charging or discharging before loosening or removing battery connections as sparks may occur.

Switch the battery circuit breaker to "OFF."

Use insulated tools and discharge all static electricity from your body before performing any work.

As always, adequate ventilation must be provided.

Battery Replacement

When to replace batteries

The IR-40EC batteries have a guaranteed lifetime of 5 years. In accordance with the Product Manual for IR-30EC and IR-40EC batteries, the batteries should be replaced after 5 years to ensure reliable performance.

Any fully charged IR-40EC battery at float that reads less than 13 V at 77°F 25°C is considered to be shorted and must be replaced.

For IR-40EC batteries that are more than 1 to 2 years old, if one fails, replace all 4 batteries.

Procedure for removing and replacing IR-40EC batteries

Use the following procedure to remove and replace one or more batteries:

Step 1. Open the front door of the cabinet.

Step 2. On the LVD ensure that the battery circuit breaker is switched "OFF." For the location of the LVD and the other parts see Installing the Power and Ringing Modules on page 10-3.

Step 3. Disconnect the battery connector J3 on the LVD temporarily.

Step 4. Loosen the wing nut above the battery hold-down bracket and remove the bracket.

Step 5. Disconnect all four IR-40EC batteries from the battery string cable.

Step 6. Remove the ring-type lug thermistor probe of the temperature compensation cable from the casing of the battery.

Step 7. Remove the batteries in reverse order as they are numbered: 4, 3, 2, 1. To ease the removal of the batteries, the long threaded rod can be unscrewed and removed temporarily.

NOTE:
Do not grip the rod at the top. Grip it only by the middle or lower portion.

Step 8. Verify the condition of the batteries. If any or all of the batteries need replacement, make sure that the new batteries are properly charged per the instructions provided with them or refer to "Battery inspection and initial charging" on page 9-10.

NOTE:
If IR-40EC batteries are older than the allowed open circuit time and have not been maintained in this period the batteries may not be installed and must be replaced.

Step 9. Unpack the first battery and inspect the battery for shipping damage/obvious damage and for any sign of acid spillage.

Step 10. Check the battery for fractured housings. Batteries with fractured housings are defective and must not be used. Return damaged batteries to the manufacturer in their original packing.

Step 11. Mark the first battery, the 2-pin connector and the cardboard box with number 1. The number is required for the installation record. Record the battery number and the installation/charging date in the Installation and Maintenance Record.

Step 12. Measure the open circuit voltage of battery No. 1 and record in the Installation and Maintenance Record.

Comment: If the measured battery voltage is below 12 V, the battery should be considered defective (cell short) and must not installed.

Step 13. Note the installation date on the sticker of each battery and also in the field *Date Installed* in the Installation and Maintenance Record.

Step 14. Position the first battery (No. 1) with its terminals facing to the front in the rear left corner of the battery compartment as shown in Figure 11-6 on page 11-11. Move the 2-pin battery assembly to the right.

Step 15. Locate the battery cable and the thermal probe cable and move them out of the way.

Step 16. Repeat Step 9. through Step 13. with the second battery (No. 2) and position it in the rear right corner of the ONU. Move the 2-pin battery assembly to the left.

Step 17. Screw in the temporarily removed long threaded rod.

Step 18. Repeat Step 9. through Step 13. with batteries No. 3 and No. 4.

Step 19. Move the batteries No. 1 and No. 3 and also batteries No. 2 and No. 4 close together and move them to the side walls of the housing.

Step 20. Connect the polarized 2-pin plugs of the batteries to the appropriate connectors of the battery cable and arrange the battery cabling in the free space between the batteries.

Step 21. Measure the battery string voltage on the outermost pins of the battery cable connector J3 and record in the Installation and Maintenance Record. Verify that the batteries are connected properly and that the polarity of each battery is correct.

Step 22. Inside the battery compartment locate the ring-type lug thermal probe that looks like a cable with a ring-type terminal and insert the terminal between the metallic case and the battery housing of battery No. 3 as shown in Figure 11-7 on page 11-11.

Step 23. Install the battery hold down bracket and tighten the wing nut securely as shown in Figure 11-8 on page 11-12.

Step 24. Reconnect the battery connector J3 on the LVD and switch the battery circuit breaker on the LVD to ON.

Response: The LEDs should exhibit the following states:

LED on the PRU	Color	State	Cause
Normal Operation	Green	Lights	Batteries connected
Warning	Yellow	Extinguished	Thermal probe connected
Alarm	Red[a]	Lights	Battery balance failure[b]
		Extinguished	Batteries and rectifier o.k.
Thermal Shutdown	Red	Extinguished	Rectifier o.k.

a. Flashes at overload.

b. If batteries are charged for the first time this failure can be ignored during the first 48 hours, if the measured battery voltage during battery installation was above 12 V.

Step 25. Verify that there are no lighted red alarm LED on the PRU.

Step 26. Close the front door of the cabinet.

Step 27. Charge the batteries for at least 48 hours without interruption.

Step 28. After 48 hours, there should be no lighted alarm LEDs on the PRU.

Procedure for replacing the battery heater pad

If the battery heater pad fails no alarm will be displayed. A replacement can be ordered and installed without service interruption.

Use the following procedure to remove and replace the battery heater pad:

Step 1. Open the front door of the cabinet.

Step 2. On the LVD ensure that the battery circuit breaker is switched “OFF”; for location of the LVD and the other parts see Installing the Power and Ringing Modules on page 10-3.

Step 3. Disconnect the battery connector J3 on the LVD temporarily.

Step 4. Loosen the wing nut above the battery hold down bracket and remove the bracket.

Step 5. Disconnect all four IR-40EC batteries from the battery string cable.

Step 6. Remove the ring lug thermistor probe of the temperature compensation cable from the casing of the battery.

Step 7. Remove the batteries in reverse order as they are numbered: 4, 3, 2, 1. To ease the removal of the batteries the long threaded rod can be unscrewed and removed temporarily.

NOTE:
Do not grip the rod at the top, grip it only by the middle or lower portion.

DANGER:

The ONU is fed by an AC power supply of 100 to 240 V AC, nominal, which also feeds the battery heater pad via the 3-pin AMP connector. Touching live parts in this connector of the optional battery heater pad can shock or cause serious injury or death.

Take care when servicing in this area.

Follow all safety warnings and local regulation practices.

Step 8. Disconnect the 3-pin AMP connection to the battery heater pad in the rear of the battery compartment.

Step 9. Carefully lift out and remove the battery tray at the bottom of the cabinet.

Step 10. The battery heater pad will be secured by a pressure sensitive adhesive (PSA) to the underside of the battery tray and by two screws on the rear bracket. Remove the screws and peel the battery heater pad off the bottom of the tray.

Step 11. If needed, clean the underside of the tray with a 50% solution of isopropyl alcohol and water.

Step 12. To install the new battery heater pad, remove the PSA backing and place the pad against the underside of the battery tray. Make certain the thermostat for the pad is positioned within the bracket at the rear of the tray and secure with the same screws.

Step 13. Re-install the battery tray into the bottom of the cabinet and set into position.

Step 14. Re-connect the 3-pin AMP connector carrying the AC power to the battery heater pad unit.

NOTE:

The batteries should be reinstalled in the opposite order that they were removed.

Step 15. Position the first battery (No. 1) with its terminals facing to the front in the rear left corner of the battery compartment as shown in Figure 11-6, page 11-11. Move the 2-pin battery assembly to the right.

Step 16. Locate the battery cable and the thermal probe cable and move them out of the way.

Step 17. Repeat Step 15. with the second battery (No. 2) and position it in the rear right corner of the ONU. Move the 2-pin battery assembly to the left.

Step 18. Screw in the temporarily removed long threaded rod.

Step 19. Repeat Step 15. with batteries No. 3 and No. 4 as shown in Figure 11-6, page 11-11.

Step 20. Move the batteries No. 1 and No. 3 and also batteries No. 2 and No. 4 close together and move them to the side walls of the housing.

Step 21. Connect the polarized 2-pin plugs of the batteries to the appropriate connectors of the battery cable and arrange the battery cabling in the free space between the batteries.

Step 22. Inside the battery compartment locate the thermal probe looking like a cable with ring type terminal and insert the terminal between the metallic case and the battery housing of battery 3 as shown in Figure 11-7 on page 11-11.

Step 23. Install the battery hold down bracket and tighten the wing nut securely as shown in Figure 11-8 on page 11-12.

Step 24. Reconnect the battery connector J3 on the LVD and switch the battery circuit breaker on the LVD to ON.

Response: The LEDs should have the following states:

LED on the PRU	Color	State	Cause
Normal Operation	Green	Lights	Batteries connected
Warning	Yellow	Extinguished	Thermal probe connected
Alarm	Red[a]	Lights	Battery balance failure[b]
		Extinguished	Batteries and rectifier o.k.
Thermal Shutdown	Red	Extinguished	Rectifier o.k.

a. Flashes at overload.

b. The batteries must be checked and the defective battery (cell short) must be replaced. Only if the batteries are charged for the first time this failure can be ignored during the first 48 hours.

Step 25. Verify that no red alarm LED on the power rectifier unit lights.

Step 26. Close the front door of the cabinet.

Installation and Maintenance Record

A

Installation and Maintenance Record

The following two pages are copies for the Installation and Maintenance Record from the Product Manual IR Series Batteries (Issue 7, Comcode 107078859).

COPY of the Tyco Product Manual IR-30EC and IR-40EC Batteries (Issue 7, Comcode 107078859)

Installation and Maintenance Record (Page 2)

Company Name: _____ Site Address: _____ Battery Type: ***IR-30EC***

Temperature Measurements on Selected Batteries											
	Measurement Date										
Battery Number	Initials										
1											
2											
3											
4											

String Float Current Measurements											
	Measurement Date										
Battery Number	Initials										
1											
2											
3											
4											

Battery Capacity Measurements							
Test Date	Battery Temperature	Start Voltage (Vdc)	End Voltage (Vdc)	Test Current (A)	Test Start Time	Test End Time	Percent Capacity

Installation and Maintenance Record

Installation and Maintenance Record (Page 1)

Company Name: _____ Site Address: _____ Battery Type: ***IR-30EC***

String Voltage: _____ Voltage across charge and discharge buses: _____ Voltage Difference: _____

If the voltage difference between the string and the charge/discharge buses is less than 0.05V, the system is ready. Make individual battery voltage measurements and record in the table below.

Voltage Measurements on Individual Batteries												
		Measurement Date										
		Initials										
Battery Number	Serial Number	Order Number										
1												
2												
3												
4												

COPY of the Tyco Product Manual IR-30EC and IR-40EC Batteries (Issue 7, Comcode 10707859)

List of Acronyms

A

A/D	analog/digital
AAL	ATM adaptation layer
ABN	active balance network
ABSBH	average busy season busy hour
AC	alternating current
ACD	automatic call distributor
ACE	ATM circuit emulation
ACF	AC fault
ACO	alarm cutoff
ADPCM	adaptive differential PCM
ADSL	asymmetric digital subscriber line
ADSL-R	ADSL transceiver unit—remote end
AFM	ATM feeder multiplexer
AID	access identifier
AIP	access interface platform or alarm interface panel (not used as ac)
AIS	alarm indication signal
AIS-L	alarm indication signal-line
AIU	access interface unit
ALC	automatic loss control; automatic level/loss compensation

ALC5	automatic loss compensation—5
ALIT	automatic line insulation test
AMI	alternate mark inversion
ANSI	American National Standards Institute
AOS	*AnyMedia* Access System operations software
AP	application pack
APOG	applications, planning, and ordering guide
ARM	access resource manager
ASCII	American standard code for information interchange
ATM	asynchronous transfer mode
ATU	alarm test unit
ATU-C	ADSL transceiver unit - Central Office
ATU-R	ADSL transceiver unit - remote end
AWG	American wire gauge

B

B8ZS	bipolar with eight zeros substitution
BAIU	broadband access interface unit
BB	broadband
BCF	battery cell fault
BDFB	battery distribution fuse bay
BER	bit error ratio
BIST	built-in self-test
BITS	building integrated timing supply
BRI	basic rate interface
BRITE	basic rate interface transmission extension
BT	bridged tap
BVC	bearer virtual channel
BVPT	bearer virtual path termination
BWM	broadcast warning message

C

C/N	carrier-to-noise ratio
CAC	connection admission control
CALRS	centralized automatic loop reporting system
CASTL	customer advocate system test lab
CBR	constant bit rate
CC	clear channel
CCITT	international telephone and telegraph consultative committee
CCN	customer change notice
CCS	hundred call seconds
CD-ROM	compact disk - read only memory
CDV	cell delay variation
CDVT	cell delay variation tolerance
CES	circuit emulation service
CES-IWF	circuit emulation service interworking function
CEV	controlled environment vault
CF	current feed
CHAN/MON	channel testing and monitoring (switch side)
CIT	craft interface terminal
CL	center line
CLF	carrier line failure
CLP	cell loss priority
CMI	control mode idle
CMIS	common management information service
CN	change notice
CO	central office
COACH	customized online aid for customer help
COMDAC	common data and control
COPM	customer operations and program management
CORRCNT	corrected HEC error counter
COT	central office terminal

CPE	customer premises equipment
CPFT	customer premises facility terminal
CPI	calling party identification
CPS	cabinet power system
CR	critical
CRC	cyclic redundancy check
CRV	call reference value
CS	current sink
CSA	carrier serving area
CSMD/CD	carrier sense multiple access/collision detection
CSS	controlled slip seconds
CSS-P	controlled slip seconds-path
CSU	channel service unit
CTS	customer technical support
CTU	craft test unit
CU	channel unit
CV	coding violation
CV-L	coding violation-line
CV-LFE	coding violations-line - far end
CV-P	coding violation-path
CV-S	coding violations-section
CVC	control virtual channel
CVPT	control virtual path termination

D

DACS	digital access cross-connect system
dB	decibel
dBm	decibel referenced to one milliwatt
DC	direct current
DCD	received line signal detector
DCE	data communication equipment
DCLU	digital carrier line unit

DCN	data communication network
DCS	digital cross-connect system
DCTP	direct current test pair
DDL	delivered data link
DDM	digital data multiplexer
DDS	digital data services
DFI	digital facilities interface
DHCP	dynamic host configuration protocol
DID	direct inward dialing
DIP	dual in-line package
DLC	digital loop carrier
DLCI	data link connection identifier
DM	degraded minute
DMT	discrete multitone
DMU	digital measurement unit
DNIS	dialed number identification service
DNS	domain name service
DNUS	digital network unit–subscriber
DOD	direct outward dialing
DP	data port or dial pulse
DPFU	dual power feed unit
DPO	dial pulse originate
DPT	dial pulse terminate
DRAM	dynamic random access memory
DS0	digital signal, level 0
DS1	digital signal, level 1
DS3	digital signal, level 3
DSL	digital subscriber line
DSP	digital signal processor
DSR	DCE ready
DSU	data service unit

DSX	digital signal cross-connect
DSX-1	digital signal cross-connect, level 1
DSX-3	digital signal cross-connect, level 3
DTC	digital trunk controller
DTE	data terminal equipment
DTMF	dual tone multifrequency
DU	data unit
DX	duplex

E

EBS	enhanced business service
EC	error correction
ECI	equipment catalog item
E&M	ear and mouth
EM	element manager
EMC	electromagnetic compatibility
EMF	electromotive force
EMI	electromagnetic interference
EMS	element management system
EOC	embedded operations channel
EPD	echo path delay
ERL	echo return loss
ES	errored seconds
ES-L	errored second-line
ESD	electrostatic discharge
ESF	extended superframe
ES-L	errored seconds-line
ES-LFE	errored seconds-line far end
ES-P	errored seconds-path
ES-S	errored seconds - section
ETO	equalized transmission only

F

4TDM	four-wire tandem
FC	failure count
FC-L	failure counts-line
FC-LFE	failure counts-line - far end
FCC	Federal Communications Commission
FCM	fuse circuit module
FDI	feeder distribution interface
FE	far end
FEAC	far end alarm and control
FELP	far end loopback
FITL	fiber in the loop
FITs	failure in 10^9 hours
fpm	flashes per minute
FPT	framed path termination
FSA	first site application
FSAN	full service access network
FTP	file transfer protocol
FX	foreign exchange
FXO	foreign exchange office
FXS	foreign exchange station
FRMGND	frameground

G

GA	general availability
GCRA	generic cell rate algorithm
GOS	grade of service
GPB	general purpose bus
GPC	general purpose communications
GR-303	Telcordia Technologies, Inc. Standard GR-303
GSFN	generic signaling function

GSI	graphical system interface
GTL	Gunning transceiver logic
GTSIP	global technical support information platform

H

HBER	high BER
HCS	header check sequence
HDBH	high day busy hour
HDLC	high-level data link control
HDSL	high bit rate digital subscriber line
HDSL2	high bit rate digital subscriber line-second generation
HDT	host digital terminal
HEC	header error code
HTTP	hypertext transfer protocol
Hz	hertz

I

I/O	input/output
IAD	integrated access device
IAT	integrated access terminal
IATSI	IAT system interface
IBERT	integrated bit error test
ICLE	initial customer laboratory evaluation
ICP	IMA control protocol
ID	identifier
IDCU	integrated digital carrier unit
IDLC	integrated digital loop carrier
IDT	integrated digital terminal
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IMA	inverse multiplexing for ATM
IMLT	integrated mechanized loop testing

INA	integrated network access
INIT	initialization/diagnostic
IP	Internet protocol
IPX	Internet packet exchange
IS	in service
ISDL	integrated subscriber digital line
ISDN	integrated services digital network
ISO	international organization for standards
ISP	Internet service providers
ITU	International Telecommunications Union
IV	ICP cell violation
IV-IMA	IPC violations (count of errored, invalid or missing IPC cells)
IXC	interexchange carrier

K

kbps	kilobits per second
kBps	kilobytes per second
kHz	kilohertz
kW	kilowatt

L

LAN	local area network
LAPD	link access protocol D-channel
LBO	lightguide build out
LCD	loss of cell delineation
LDS	local digital switch
LED	light-emitting diode
LFACS	loop facilities assignment and control system
LFP	logical feeder port
LLN	logical line number
LMI	local management interface
LOCD	loss of cell delineation

LOF (lof)	loss of frame
LOFA	loss of frame alignment
LOP	loss of pointer
LOS (los)	loss of signal
LOST	loss of signal timeout
LSAS	line side answer supervision
LTD	local test desk
LTF	loop test frame
LTS	loop test system
LULT	line unit network termination
LUNT	line unit network termination
LVD	low voltage disconnect

M

mA	milliampere
MAT	Metropolitan Area T-carrier
Mbps	megabits per second
MBps	Megabytes per second
MBS	maximum burst size
MDF	main distributing frame
MDS2	metallic distribution shelf 2
MDSU	metallic distribution server unit
MEA	mismatch of equipment and attributes
MHz	mega hertz
MIB	management information base
MJ	major
MLTS	multiline telecommunications system
MMSU	modular metallic service unit
MN	minor
MR	modification request
ms	millisecond
MSC	metallic shelf controller

MSG	message switch
MTBF	mean time between failures
MTU	maximum transfer unit
MVEC	majority vote error correction

N

NB	narrowband
NCTE	network channel terminating equipment
NE	near end or network element
NEBS	network equipment building systems
NEC	national electric code
NI	network interface
NIC	network interface card
NMP	network management protocol
NMS	network management station
nrt-VBR	nonreal time variable bit rate
NSA	nonservice affecting
NT 1	network termination - 1
NTP	network time protocol
NTT	no test trunk
NTR	network timing reference
NVDS	nonvolatile data storage
NVPS	nonvolatile program storage

O

OAM&P	operations, administration, maintenance, and provisioning
OAP	optical application pack
OC	optical carrier
OCD	out of cell
OCP	optical controller pack
OCU	office channel unit
OE	originating equipment

OHT	on-hook transmission
OLIU	optical line interface unit
ONU	optical network unit
OOS	out of service
OPS/INE	operations system for intelligent network
OS	operations system
OSMINE	operations systems modification of intelligent network elements
OSP	outside plant
OTGR	operations technology generic requirements

P

P-AIS	path alarm indication signal
P/AR	peak to average ratio
PAM	pulse amplitude modulation
PBX	private branch exchange
PC	personal computer
PCI	peripheral component interconnect
PCM	pulse code modulation
PCR	peak cell rate
PDF	portable document format
PDU	protocol data unit
PFP	physical feeder port
PGTC	pair gain test controller
PIDB	processor interface data bus
PLAR	private line automatic ring
PLCP	physical layer convergence protocol
PLN	physical line number
PLR	pulse line repeater
POTS	plain old telephone service
ppm	parts per million
PPP	point to point protocol
PRC-Access	Product Realization Center-Access

PRF	power rectifier fault
PRI	primary rate interface
PRS	primary reference source
PRU	power rectifier unit
PSAP	public safety answering point
PSC	protection switching counts
PSD	power spectral density
PSDM	power spectral density mask
PSES	p-bit severely errored seconds
PSTN	public switched telecommunications network
PTU	power and test unit
PVC	permanent virtual circuit
PVP	permanent virtual path

Q

QMON	quality monitoring
QoS	quality of service

R

RACO	remote alarm cutoff
RADSL	rate adaptive digital subscriber line
RAI	remote alarm indication
RAM	random access memory
RCLK	receive clock
RC/V	recent change/verify
RD	ring down
RDI	remote defect indication
REFCLK	reference clock
REN	ringing equivalence number
RFI	remote failure indication
RGU	ringing generator unit
RIP	routing information protocol

RMC	remote maintenance connection
RMU	remote measurement unit
ROC	remote operations channel
R-S	Reed-Solomon
RSF	receive signal failed
RT	remote terminal
rt-VBR	real time variable bit rate
RTAC	regional technical assistance center
RTLP	receive transmission level point
RTU	remote test unit
Rx-UUS-IMA	receive unusable seconds-IMA

S

SA	service affecting
SARTS	Switched Access Remote Test System
SAS-P	severely errored framing/alarm indication signal seconds-path
SCEC	second channel error correction
SCR	sustained cell rate
SDSL	symmetric digital subscriber line
SEFS	severely errored framing seconds
SEFS-P	severely errored framing seconds-path
SEFS-S	severely errored framing seconds-section
SES	severely errored seconds
SES-P	severely errored second-path
SES-S	severely errored seconds-section
SES-IMA	severely errored seconds-IMA
SES-L	severely errored seconds-line
SES-LFE	severely errored seconds-line far end
SES-P	severely errored seconds-path
SES-S	severely errored seconds-seconds
SF	superframe
SHDSL	single-pair high speed digital subscriber line

shelf_PCR	shelf peak cell rate
SID	source identifier
SL	selecting slope
SNMP	simple network management protocol
SNR	signal to noise ratio
SONET	synchronous optical network
SWDL	software download

T

TAP	test access path
TAP100	test application pack
TBCU	test bus control unit
TC	TAP connected
TCA	threshold crossing alert
TCP/IP	transmission control protocol/Internet protocol
TDM	time division multiplexing
TDR	time domain reflectometry
TL1	transaction language -1
TL1SI	TL1 system interface
TLP	transmission level point or test level point
TMC	timeslot management channel
TMS	transmission (test) measuring set
TO	transmission only
TOS	test operations system
TR	technical reference
TR-08	Telcordia Technologies, Inc. Standard TR-008
TSA	timeslot assignment
TSC	test system controller
TSG	timing signal generator
TSI	time slot interchange
TTF	transmission test facility

TTLP	transmit transmission level point
Tx-UUS-IMA	transmit unusable seconds-IMA

U

UART	universal asynchronous receiver/transmitter
UAS	unavailable seconds
UAS-IMA	unavailable seconds-IMA
UAS-L	unavailable seconds-line
UAS-LFE	unavailable seconds-line far end
UAS-P	unavailable seconds-path
UBR	unspecified bit rate
UCC	universal communication channel
UDP	user datagram protocol
UDT	unstructured data transfer
U-DSL	U-interface digital subscriber line
UIP	user interface panel
UNCCNT	uncorrected HEC error counter
UNI	user network interface
UPC	usage parameter control
USB	universal serial bus
UPN	urgent problem notification
UVG	universal voice grade

V

VB	virtual bank
VBR	variable bit rate
VC	virtual circuit (traditional DLC services) or virtual channel (ATM xDSL services)
VCC	virtual channel connection
VCI	virtual channel identifier
VCOT	virtual central office terminal
VDC	volts direct current

VDSL	very high speed digital subscriber line
VF	voice frequency
VFDE	voice frequency data enhancement
VGA	video graphics array
VoDSL	voice over digital subscriber line
VOM	volt ohm meter
VP	virtual path
VPC	virtual path connection
VPI	virtual path identifier
VPN	virtual private network
VPT	virtual path termination
VRLA	valve-regulated lead-acid
Vrms	volts root mean square
VRT	virtual remote terminal
VT	virtual tributary

W

WAN	wide area network
WATS	wide area telephone service
WL	working length
WRR	weighted round robin

X

XTC	extended test controller

Z

ZBS	zero byte substitution
ZCS	zero code suppression

Glossary

Numerics

10BaseT — IEEE 802.3 standard for Ethernet transmission over unshielded twisted pair.

A

Access interface platform — A family of equipment that provides cost-effective and flexible access for different services; e.g., voice and data, using a common platform.

ACE COMDAC — An ATM COMDAC which implements circuit emulation service (CES) for the DS1 links to the backbone network using unstructured data transfer mode (UDT).

Admissible bandwidth — The amount of bandwidth allocated to a service category in the upstream and downstream directions (not applicable to UBR). The sum of the effective bandwidths allocated to a ll connections supported by a service category, divided by the overbooking factor of that service category, must no exceed the admissible bandwidth of this service category. The admissible bandwidth of a service category may not exceed the shelf PCR.

ADSL-lite — A version of asymmetric digital subscriber line (ADSL) that is less expensive than full-rate ADSL and that operates at a lower bit rate than full-rate ADSL. This version of ADSL is specified in ITU-T G.992.2.

AFMO logical feeder port — An entity used to address a SONET path or a protection group.The logical feeder port concept allows addressing of attributes or entities that are common to all physical feeder ports associated with the logical feeder port and that are independent of simplex or duplex mode. The AFMO and the AFMDS3 have two logical feeder ports.

AFMO physical feeder port

Corresponds to the physical termination of the optical feeder. The physical feeder port concept allows the addressing of SONET physical medium, selection, and line layer entities. An *AnyMedia* shelf has two physical feeder ports when using one AFMO in simplex mode and four physical feeder ports when using two AFMOs in duplex mode.

***AnyMedia* operations gateway**

Operations access for up to 20 RTs via universal communication channels (UCCs).

Application layer (OSI)

A layer of OSIRM. Provides the management of communications between user applications. Examples include e-mail and file transfer.

Asymmetric digital subscriber line (ADSL)

A method of data transmission over unloaded copper loops. The data rate transmitted toward the end user is typically much higher (e.g., 6 Mbps) than the data rate transmitted by the end user (e.g., 640 Kbps).

Asynchronous transfer mode (ATM)

A high-speed connection-oriented mulitplexing and switching method that utilizes fixed-length cells to support multiple types of traffic. Transmission is synchronized at the start and end of each character, allowing different types of services to be carried over one system.

ATM adaptation layer (AAL)

A set of internationally standardized protocols and formats that define support for circuit emulation, packet video and audio, and connection-oriented and connectionless data services. There are four standard protocols defined for AAL—AAL1, AAL2, AAL3/4, and AAL5.

AAL5 is used for bursty LAN traffic and uses the conventional five-byte ATM header. AAL5 does not support cell multiplexing.

ATM feeder

The connection from the AFM to the ATM transport network. This connection may be either DS3, DS1, or OC-3c. The ATM feeder may connect directly to an ATM switch or access concentrator device. In addition, the connection between the AFM and the switch or access concentrator may incorporate a multiplexer. In daisy-chained configurations, the ATM feeder for each AFM, except the one closest to the switch or access concentrator, connects to the previous AFM in the chain. This connection may be direct or through a multiplexer. Note that daisy-chaining is available only with DS3 and OC-3c AFMs.

ATM-RSF on ADSL line

Ten consecutive seconds with each second having one or more of the following anomalies:

At least 18 ADSL superframes with ATM HEC anomalies

At least one ADSL superframe with ATM cell delineation anomalies.

ATM technology Asynchronous transfer mode is a data communications format in which transmission is synchronized at the start and end of each character, allowing different types of services to be carried over one system.

ATM traffic statistics For the *AnyMedia* Access System, ATM traffic statistics refers to the performance monitoring function for ATM cell counts. ATM traffic statistics can be collected either at the shelf level, or for specific connections. At the connection level, the technician may choose to activate ATM traffic statistics for all connections on an AP, for all connections on an end-user port, or for an individual connection.

ATM xDSL subsystem The *AnyMedia* Access System components that are needed to provide ATM xDSL services, i.e., the AFM, OAP, OCP, ADSL AP, SDSL AP and SHDSL AP. Note that the OAP and OCP can carry both ATM xDSL and traditional DLC traffic and are included in both the ATM xDSL and traditional DLC subsystems. Components that only carry traditional DLC services (e.g., the TDM COMDAC) are not included in the ATM xDSL subsystem. The ACE COMDAC is a component of both the traditional DLC and ATM xDSL subsystems.

Attenuation of ADSL line The difference in dB between the power received at the far end and the power transmitted by the near end.

Authentication Process used to verify that only those users or operating systems authorized to access the system are permitted to do so and to ensure that the user or operating system is only allowed to alter or extract its authorized data.

Auto discovery Automatically updates and maintains an inventory of the *AnyMedia FAST* shelf.

Autonomous reports Messages sent by the *AnyMedia* Access System to operations systems or element managers (EMs) to report conditions such as errors, faults, and threshold crossings. The *AnyMedia* Access System's processors decide when or what messages are sent; they are not externally requested.

B

Basic rate interface (BRI) An ISDN access interface type made up of two B channels, each at 64 kbps, and one D channel at 16 kbps (2B+D).

B channel An ISDN bearer service channel that can carry either voice or data at a speed of 64 kbps.

Bit error ratio The quality of transmission is measured in the number of errored bits per number of bits received.

Broadband services High speed data and asynchronous transfer mode services.

C

Cell — A fixed-length 53-octet packet used in ATM. The AM cell has a 5-octet header and a 48-octet payload.

Cell delay variation (CDV) — The amount of difference between a cell's expected arrival time and its actual arrival time. Also called "jitter".

Cell delay variation tolerance (CDVT) — A parameter which, in CBR transmissions, determines the level of jitter (i.e., cell delay variation). The upper bound on the jitter measurement is the CDVT.

Cell header — A 5-octet header that defines control information used in processing, multiplexing, and switching cells.

Cell loss priority — A field in the ATM cell header showing two levels of priority for ATM cells. CLP=0 cells are a higher priority than CLP=1 cells and may be discarded if there is a congestion to preserve the cell loss ratio of CLP=0 cells.

Cell loss ratio (CLR) — The value the network agrees to offer as an objective over the lifetime of the connection. This value is specified per service class at the turn-up.

Cell transfer delay (CTD) — The transit delay of an ATM cell successfully passed between two designated boundaries on the *AnyMedia* Access System, when the system is loaded conservatively.

Cells received — The total number of cells that the shelf received from the CPE.

Channel — The electronics portion of a digital loop carrier line; typically from the tip/ring output of the channel unit or application pack toward the central office. Includes up to the switch interface if integrated DLC. Includes the transmit and receive DS0s, codecs, and hybrids.

Circuit emulation service (CES) — An ATM configuration that allows the ATM network to act as a transparent transport pipe for constant bit-rate circuits.

CES interworking function (CES-IWF) — That part of a CES system that interfaces the signal to be emulated, converting such signals to ATM format in the transmit direction and converting ATM signals to the original format in the receive direction.

Circuit pack protection — The capability for a given pack to relinquish its functionality to another instance of the same circuit pack. The circuit pack that provides system functionality is called the *active* pack, while the circuit pack that protects the active pack is called the *standby* pack. When a switch occurs, the roles of the active and standby circuit packs are reversed. A switch occurs, for example, when the active pack fails or when an administrator issues an OAM&P command.

***ClearReach* feature**	The *ClearReach* feature for the *ConnectReach* and *ConnectReach Plus* terminals that improves modem performance. The *ClearReach* feature requires voice frequency data enhancement (VFDE) in the *AnyMedia FAST* shelf.
Collocation	Grouping entities in the same physical location.
Common unit	A unit, or application pack, that performs the main bandwidth management and control for the *AnyMedia FAST* shelf.
Competitive access	The ability for nonincumbent carriers to provide local access.
Configuration management	Consists of a set of functions to exercise control over elements in the network, including initialization, parameter setting, starting and stopping, and collection of information about the configuration.
Connection admission control (CAC)	CAC is a set of actions taken by the network during the call set-up phase to determine whether a connection request can be accepted, should be rejected, or may be re-allocated based on QoS definitions.
COSET	The header error co-setting (55 hex by ATM standards) is used to maintain a value other than zero in the header error code (HEC) field. If the first four bytes in the header are zero, the HEC derived from these bytes is also zero. When this occurs and there are a string of zeros in the data, the receiver cannot determine the cell boundaries. Therefore, it is recommended that the value 55 hex be added to the HEC before transmission.
Craft interface terminal (CIT) port	The port on the craft test unit (CTU) where the graphical system interface (GSI) or a TL1 system interface (TL1SI) is connected.
Customer premises equipment (CPE)	Equipment that resides and is operated at a customer site.
Cyclic redundancy check (CRC)	An algorithm that detects bit errors causes in data transmission.

D

D4	A framing and synchronization format for T1 transmission facilities.
Dangler cable	Cable that effectively brings a backplane connector to the front of the shelf.
Database evolution	When AFM software is upgraded to provide new features, it is usually necessary to adapt or extend the database structure to accommodate these features. This is done automatically as part of software activation and is termed database evolution.
Data communications (or circuit termination) equipment (DCE)	A modem or network communications interface device.

Data terminal equipment (DTE)	Data processing equipment that interfaces to the communications network (DCE).
DC alarm services	Point-to-point metallic services that connect subscriber premises with fire, police, or security services' monitoring locations. These services are delivered by the MDS2 shelf using DC circuit-emulation technology provided by *MCU* CUs from Tollgrade Communications, Inc.
D channel	The ISDN out-of-band (16 kbps in BRI) signaling channel that carries the ISDN user signals or can be used to carry packet-mode data.
Degrowth	The removal of circuit packs or traffic from a system via a provisioning operation (may be accompanied by the physical removal of associated equipment, but this is not required).
Digital bypass pair	A pair of MDS2 CUs (such as the *Tollgrade MCU*-5405 CUs) that provide the equivalent of a metallic bypass pair without requiring a physical copper pair.
Digital data services	Digital data services refer to 64 kbps clear channel digital service provided between the customer and the CO.
Digital signal 0 (DS0)	One 56-kbps framed channel out of the 24 contained in a DS1 channel.
Digital signal 1 (DS1)	The North American standard 1.544-Mbps digital channel.
Digital signal 3 (DS3)	The North American standard 44.736-Mbps digital channel.
Discarded cells	Cells that are dropped to avoid exceeding a particular connection's traffic contract.
Distribution cable	The cable from the field side of an FDI to the customer's ready access case or distribution box, but not including the drop (formal definition) or inside wiring.
Downstream direction	Transmission direction from ATM data network or telephony switch to customer.
Downstream VP	In a daisy chain, a VP that terminates on a shelf that is farther away from the ATM transport network than the shelf being addressed. "Downstream" here does not refer to the direction of transmission.
Drop	Formal definition is the short cable from an aerial ready access case or buried plant distribution box to the customer's house, not including inside wiring. Informally used, especially when describing test configurations like "splitting access," to be equal to line or loop. In this latter informal case (loop), it is all the copper cable to and including the telephone set.
Dropped cells	The number of cells that are dropped as a result of exceeding either a particular connection's traffic contract or the total allowable bandwidth of the shelf.

DS1 framing format The prescribed recurring pattern of bits transmitted that enables the receiver to identify the start of a frame and the frame number in a sequence of frames. The system supports two different DS1 frame formats, extended superframe (ESF), or superframe (SF).

DS1 link The general term *DS1 link* can denote a physical DS1 link when using a TDM COMDAC, or a circuit emulated link when using an ACE COMDAC.

DS1 logical feeder port These ports are associated with the VRT structure of the *AnyMedia* Access System. The VRT structure allows the flexible assignment of APs and CUs to VRTs that are associated with specific functional needs of partitioning the *AnyMedia* Access System. Three forms of VRTs are allowed: GR-303 (up to 3 allowed), TR-08 (up to 20 allowed), and INA (up to 20 allowed). The total number of VRTs and the DS1 content of each VRT are limited by the total number of DS1 physical feeder ports. Any DS1 physical feeder port can be associated with any DS1 logical feeder port.

DS1 physical feeder port These ports provide two twisted pair transmit/receive DS1 interfaces to the *AnyMedia* Access System. Up to 20 DS1 physical feeder ports are available and are physically identified through the AID with the DS1 (shelf number), pack number (1 to 5), and the port number (1 to 4).

Dying gasp A message the ATU-R transmits to the ATU-C when its electrical power is being shut off. The message indicates to a service technician or an administrator that an interruption on an ADSL line was caused by a power interruption at the ATU-R and not caused by a transmission failure or an *AnyMedia FAST* shelf failure.

E

Early packet discard The early packet discard function ensures that the ATM equipment discards entire AAL5 packets during periods of congestion. This is especially important when a relatively large number of Transmission Control Protocol (TCP) sources contend for a particular bottleneck.

Effective bandwidth A measure of the amount of bandwidth a connection uses. For CBR connections, it equals PCR. For VBR connections, it is a function of PCR, SCR, MBS, and CLR. For VBR connections, this measure is defined differently for different congestion points on the same connection. The CAC algorithm uses this measure at potential congestion points when determining whether to admit a new connection.

Errored cells Cells having an invalid header field after HEC procedures are completed.

Errored cells received The number of cells that the shelf received from the CPE with detected errors.

ES on upstream SDSL line The corrected HEC error counter (CORRCNT) and the uncorrected HEC error counter (UNCCNT) event counter data are accumulated and mapped to ES. The total count in one second is the number of ESs. The HEC error counter data is accumulated, and the ES counts are reported on a 15-minute and 1-day basis. The CORRCNT counter tracks the number of corrected HEC errors. The UNCCNT counter tracks the number of uncorrected HEC errors.

Ethernet A LAN that uses the CSAM/CD media access method and operates at 10 Mbps, usually over coax medium.

F

Facility protection The capability for a system to choose which signal from two facilities to pass along to the internal, unprotected transmission paths. A system switches from one facility to the other, for example, when the facility being used fails or when an administrator issues an OAM&P command.

Fault management Consists of a set of functions, such as testing, that enable the detection, isolation, and correction of abnormal operation of the telecommunications network and its environment.

Feeder cable The portion of a customer loop from the central office switch (integrated), or from the main distribution frame (MDF) to the office side of the feeder/distribution interface (FDI). In the case of DLC it includes the DLC line plus any copper cable from the RT to the FDI.

Fixed wireless network A digital loop carrier (DLC) system that uses wireless (radio) transmission through the air as the distribution medium to the home, replacing the traditional copper wire outside plant. A radio unit is mounted on the outside of the home (network interface unit) and is connected to standard twisted pair wiring within the home.

FLASH memory device A nonvolatile memory device that may be reprogrammed in the field through software download.

Framed path termination The physical framer device on the ACE COMDAC which terminates a DS1 signal delivered by a CES-IWF. There is one framed path termination corresponding to each logical DS1 port on the ACE COMDAC.

Front and rear access The mounting of the bay with its back away from a wall, etc., which allows access to the rear of the shelves.

Front-only access The mounting of the bay with its back next to a wall, etc., which prohibits access to the rear of the shelves.

Full-rate ADSL The version of asymmetric digital subscriber line (ADSL) defined by *ANSI* T1.413.

G

General user — User login that allows access to all messages except those for Security Management messages that affect other users, such as login creation and deletion, and password modification for all user classes.

Generic cell rate algorithm (GCRA) — For each cell arrival the GCRA determines whether the cell conforms to the traffic contract of the connection. The GCRA is defined with two parameters: the increment (I) and the limit (L).

Generic signaling function — A parameter required for provisioning of subscriber service. The generic signaling function is used to condition the *AnyMedia FAST* shelf loop interface circuit to provide the desired signaling protocol. The values are based on Network Channel Interface (NCI) codes described in Telcordia Technologies, Inc. TR-TSY-000335.

GET — The simple network management protocol (SNMP) operation used by the OS to retrieve specified information such as the values of MIB variables.

Global ATM parameters — Includes the *FAST* shelf VPIs and the ATM operations channel VPI and VCI (also known as ATM OAM&P PVC).

Graphical system interface (GSI) — The GSI is part of the Management Interface package of software that is an interface to control and maintain the *AnyMedia FAST* shelf telephony and data services and subshelves.

Guaranteed bandwidth — The portion of the feeder throughput (feeder bandwidth) made available to a service category to be used during periods of sustained congestion. Guaranteed bandwidth is explicitly specified for CBR, rt-VBR, and nrt-VBR by means of provisioning the weights for the Weighted Round Robin (WRR) Scheduler. The sum of all guaranteed bandwidths may not exceed the feeder bandwidth.

H

Hi-cap — High capacity (hi-cap) subscriber services direct DS1 paths from subscriber equipment to the serving CO.

High BER on ADSL line — Ten consecutive seconds with each second having one or more of the following anomalies:

At least 18 ADSL superframes with ADSL CRC anomalies

At least 0.1 seconds in which the received power has dropped to 6 dB below the reference power

At least one ADSL superframe with synchronization anomalies.

High BER on upstream SDSL line

The SDSL signal received from the CPE is considered to be in a high-BER condition when ten consecutive SESs have occurred. The high-BER condition is cleared when ten consecutive seconds have occurred that are not SESs. The system tracks SESs for the SDSL signal received from the CPE. An SES for upstream SDSL transmission is observed when either of the following conditions exists during a given clock second:

If the number of HEC errors (corrected and uncorrected) divided by the number of cells received is greater than or equal to 0.3, then SES occurs.

If at least one los or lof occurs, then SES occurs.

If an auto change in bit rate occurs, start over in both cases.

High bit rate digital subscriber line (HDSL)

A method of transmitting T1 over twisted-pair copper lines. Unlike other DSL types, HDSL uses four wires (two pairs). HDSL supports 1.544 Mbps full-duplex transmission.

I

IAT01

IAT01 indicates an IAT type supported by a proprietary (modified D4) interface such as *ConnectReach* and *ConnectReach Plus* terminals.

IAT02

IAT02 indicates an IAT type supported by a D4 open interface.

IATSI view

A window available on the GSI that is launched by executing the `ACT-IAT` TL1 command.

IMA group

An operational collection of IMA links that functions to multiplex and de-multiplex ATM cells in a cyclical fashion among the links, to form a higher bandwidth logical path between a pair of IMA terminals separated by multiple feeders. The AFMDS1 pack uses one group and up to eight links, with a direct, one-to-one mapping between the links and feeders.

IMA link

A circuit path within the AFMDS1 that connects its feeder interface with a circuit that combines the link's broadband payload (ATM cells) with the payload of other links, in the downstream direction, and distributes the composite ATM payload cells among the links in the upstream direction.

Integrated access device (IAD)

A device on the customer premises that consolidates traffic from several subscriber interfaces into a single pipe. Often, the pipe connects to a host terminal that consolidates traffic from several IADs into a larger pipe.

Integrated configuration

A remote terminal (RT) connected to a local digital switch (LDS) digital interface without a central office terminal (COT).

Integrated Mechanized Loop Testing (IMLT) IMLT is a feature of the *5ESS* switch that allows LoopCare (formerly MLT) to use the directly connected test unit (DCTU) of the *5ESS* switch to make metallic tests on subscriber loops (including those on digital loop carrier systems).

Integrated services digital network (ISDN) CCITT I-series recommendation that defines the digital network standard for integrated voice and data network access and services and user-network messages.

Inventory management Consists of a set of functions to track, report, and ensure adequate supplies of equipment.

L

Latency In the *AnyMedia* Access System, this parameter is used to choose whether or not interleaving is used on an ADSL circuit. If the latency parameter is set to Interleaved, then interleaving is used. If the Latency parameter is set to Fast, then interleaving is not used. This parameter is called Latency because the amount of transmission delay through an ADSL transmission span is affected by interleaving.

Legacy services A large set of service types traditionally supported by the DLC network element (NE).

Lightguide build out (LBO) An attenuation network for optical signals between ATM circuit packs in an ATM switch or multiplexer and the AFMOs in an *AnyMedia* shelf, or between separate AMFOs in multiple *AnyMedia* shelves in a daisy chain. LBO guarantees the proper signal level.

Line Formally represents the connection from the customer's telephone to the switch. Has been recently used to represent the copper cable from the DLC channel unit's or application pack's tip/ring output to the customer's telephone. Used equivalent to "loop," but usually does not include the telephone set.

Local login Login into the *AnyMedia* Access System via the CIT or External System LAN 10BaseT interface from the collocated GSI or dumb terminal.

Local test desk LTD is a test position located in a local end office that is capable of accessing and making metallic tests on subscriber loops served out of that office (including those on digital loop carrier systems).

Local VP A VP that is cross-connected at the VP level on the AFM.

LOF on ADSL line ADSL frame synchronization has been lost at the ADSL for at least 2.5 seconds.

LOF on upstream SDSL line The SDSL signal from the CPE is considered to be in a LOF condition after 2.5 ± 0.5 seconds of contiguous lof defect. The LOF condition is cleared when 10 ± 0.5 seconds have occurred that do not have the lof defect. The loss of cell delineation (LOCD) event counter data is mapped to lof. The firmware collects this 0.5-second interval data. If there are 2.5 seconds of contiguous lof, it is considered to be LOF. This LOCD event counter data is accumulated and reported on a 15-minute and 1-day basis.

Logical feeder port An entity used to address a SONET path or a protection group. The logical feeder port concept allows addressing of attributes or entities that are common to all physical feeder ports associated with the logical feeder port and that are independent of simplex or duplex mode. The AFMO has two logical feeder ports.

Logical ports Port assignments made through software, as opposed to actual, physical ports.

Loop Formally represents the connection from the customer's telephone to the switch. Has been recently used to represent the copper cable from the DLC channel unit's or application pack's tip/ring output to the customer's telephone. Used equivalent to "line," but may include the telephone set also.

LoopCare LoopCare (formerly called MLT) is a Tollgrade testing operations system capable of making both narrowband and broadband tests on subscriber lines and of analyzing and reporting the results of these tests.

LOS on ADSL line Received power has dropped to 6 dB below the reference power. The timing threshold is as follows:

Downstream: 1.5 seconds

Upstream: 2.5 seconds.

LOS on upstream SDSL line The loss of signal interrupts are timed, accumulated, and stored and are mapped to los. The loss of signal timeout (LOST) is used to time the los. If the LOST bit is set, then it is a LOS condition. The firmware collects this data, accumulates it, and reports the number of los occurrences on a 15-minute and 1-day basis. The LOS failure parameter is the accumulated los.

M

Management Interface The Management Interface is a package of software that is used for managing traditional DLC services and ATM xDSL services.The Management Interface allows the user to provision a single NE at a time through its GSI, while simultaneously monitoring alarms of multiple NEs through its Network Maintenance Manager. It is installed on a personal computer running under the *Windows* operating system.

Management information base (MIB)
Declaration of a collection of objects that defines the network or network element (NE) for a given interface protocol. For example, there is a MIB defined for access using the simple network management protocol (SNMP) and a different MIB defined for access using the protocol of the GR-303 Embedded Operations Channel (EOC).

Maximum burst size (MBS)
Specifies the largest burst of data above the insured rate that will be allowed temporarily on an ATM PVC, but will not be dropped at the edge by the traffic policing function, even if it exceeds the maximum rate.

In the signaling message, the burst tolerance is conveyed through the MBS, which is coded as a number of cells. The burst tolerance together with the sustainable cell rate and the generic cell rate algorithm determine the MBS that may be transmitted at the peak rate and still be in conformance with the generic cell rate algorithm.

Metallic bypass pair
A physical copper pair running between the CO and the RT site that allows a test head located at the CO to perform metallic tests on RT subscriber drops.

Minimum bit rate
The minimum rate at which the ADSL and SDSL and SHDSL link will train, upstream and downstream. This rate is used to in determining whether a new connection can be admitted to the shelf.

Mismatch of equipment and attributes (MEA) alarm
This alarm signals that the equipped pack and its provisioning do not match. The alarm is cleared either by deleting the cross-connect or by replacing the pack with one that supports the service category.

Multiplexing
The technique of combining multiple single channels onto a single aggregate channel for sharing facilities and bandwidth.

Multi-point grounding
The circuit and frame (earth) grounds are tied together at each piece of equipment. This allows battery return to use the building ground as a path. Multi-point grounding is also called mesh, integrated ground plane, or common bonding network . (See single-point grounding.)

N

Narrowband services
Services include voice and voice-frequency data transmission.

NE name
The network element (NE) name is a unique provisioned name given to an *AnyMedia* shelf. This name is identified by the GSI as the site ID.

Network Maintenance Manager
The Network Maintenance Manager is part of the Management Interface package of software that is used to monitor alarms over multiple NEs. The Network Maintenance Manager allows a user to choose which NEs to monitor, to filter viewed alarms, and to manage the display of these alarms

Non-real time variable bit rate (nrt-VBR)	A service category for data traffic that has no fixed timing relationships but has a guaranteed QoS. Statistical multiplexing is provided to make optimum use of network resources.
Nonvolatile data storage (NVDS)	That part of the database which is retained even after a power failure, for example, provisioning parameters.
Nonvolatile program storage (NVPS)	Nonvolatile memory on the COMDAC and the AFM used to store the load image.

O

OLIU	An optical line interface unit (OLIU) circuit pack interfaces with a SONET multiplexer's optical line in the transmit and receive directions.
Open systems interconnection reference model (OSIRM)	A seven-layer model that defines the protocol standards for data communications.
Operations system (OS)	A centralized system of software and/or hardware for remotely testing or administering telecommunications equipment (e.g., SARTS, LoopCare [formerly MLT], OPS/INE, etc.)
Optical carrier level *N* (OC-*N*)	The optical carrier level signal in SONET that results from an STS-*N* signal conversion. In SONET, the basic transmission speed unit is 58.34 Mbps.
Overlay solutions	Additional infrastructure to carry new services.

P

Packet switch public data network (PSPDN)	A public data network that utilizes packet switching technology (X.25, SMDS, ATM).
Partial packet discard (PPD)	In severe ATM traffic congestion, the traffic manager discards packets arriving from any connection, regardless of whether or not the traffic on the connection is exceeding its bandwidth. The traffic manager discards all remaining cells in the packet, even if the severe congestion clears in the meantime.
Peak cell rate (PCR)	A traffic parameter measured in cells per second that specifies the maximum number of cells that can be transmitted on an ATM network. PCR defines the shortest period between two cells.
Performance management	Consists of a set of functions to evaluate and report on the behavior of telecommunication equipment and the effectiveness of the network and/or network elements (NEs).
Permanent virtual circuit (PVC)	A logical dedicated circuit between two user ports in a point-to-point configuration.

Physical feeder port Corresponds to the physical termination of the optical feeder. The physical feeder port concept allows the addressing of SONET physical medium, section, and line layer entities. An *AnyMedia* shelf has two physical feeder ports when using one AFMO in simplex mode and four physical feeder ports when using two AFMOs in duplex mode.

Physical layer convergence protocol (PLCP) The IEEE 802.6 standard that defines the physical layer that adapts the actual capabilities of the underlying physical network to provide the services required by the ATM layer.

Private (automatic) branch exchange (PBX/ PABX) A customer-site telephone switch.

Privileged user User login allows access to all TL1 commands and GSI capabilities.

Protected pack A circuit pack for which there is a backup. Protection may be one-to one, or it may be one-to-more-than-one (1:n).

Protection switching A reliability feature that causes service to switch to the backup equipment during faults or testing.

PSD of ADSL transmission The actual ADSL transmit power level. This value may be lower than the provisioned PSDM.

PSDM of ADSL transmission A provisionable value representing the maximum allowed ADSL transmit power level. The ADSL transceiver may choose a lower power level based on line conditions.

Pulse code modulation (PCM) Modulation in which an analog signal is sampled and the sample is quantized and coded. Standard North American sampling is 8,000 times per second with 8 bits representing each sample pulse, giving a transmission rate of 64 kbps.

Q

Quality of service (QoS) An indicator of the performance of a transmission system on the Internet and other networks. QoS is measured in transmission rate, error rates, latency, and other characteristics.

R

Real-time variable bit rate (rt-VBR) A service category with strict cell transfer and delay variation demands and cell loss requirements.

Remote login Login into the *AnyMedia* Access System via IAO LAN, ROC, or External System LAN (over TCP/IP DCN) from OSs, EM, or GSI.

Reports-only user - broadband User login that allows access to GET messages for retrieving system information and autonomous reports. Reports-only users do not have access to any SNMP messages that create, change or remove service or to any security messages that affect other users.

Reports-only user - narrowband — User login that allows access to a limited set of TL1 messages, for retrieving system information and autonomous messages. Reports-only users do not have access to any TL1 messages that create, change or remove service to any security messages that affect other users.

RFI on ADSL line — ADSL frame synchronization has been lost at the ATU-R for at least 1.5 seconds.

Right-of-way — Permission to have access to specified local network and to use a specific portion of it.

Ring — A closed-loop, common bus network topology.

Router — A LAN/WAN device that operates at layers 1 (physical), 2 (data link), and 3 (network) of the OSIRM. Distinguished from a bridge by its capability to switch and route data based upon network protocols such as IP.

S

Sealing current — 5 mA current used (historically) to prevent oxidation buildup on tip/ring pairs.

Security management — Consists of a set of functions that protect telecommunications networks and systems from unauthorized access by persons, acts, or influences, and to track and report access attempts.

SET — The simple network management protocol (SNMP) operation used by the OS to change the value of specified information such as a MIB variable.

Shelf daisy-chain — Connecting *AnyMedia FAST* shelves to daisy-chain AFMs together for ADSL services only.

Shelf overbooking factor — Overbooking means allocating bandwidth to connections on a port, where their total bandwidth allocation is greater than bandwidth minus CAC Reserve. Booking can exceed bandwidth and also the bandwidth of the port, but traffic throughput can never exceed bandwidth.

Shelf PCR — The amount of bandwidth allocated by provisioning to a shelf.

Shelf VP — A feeder VP for which the ATM xDSL subsystem supports VC cross-connects.

Simple network management protocol (SNMP) — Used by the OS and the GCT for the AnyMedia *FAST* shelf broadband product for accessing the MIB objects.

Single-pair high speed digital subscriber line (SHDSL) A physical layer technology used to transport digital bit stream over one pair of nonloaded existing copper distribution cable. SHDSL provides equal transmission bit rates for both the upstream and downstream directions ranging from 192 to 2304 kbps. SHDSL is based on use of the TC-PAM line coding scheme. TC-PAM is a baseband line coding scheme that does not allow the option to share the copper loop from a baseband POTS signal.

Single-point grounding The circuit and frame (earth) grounds are tied together at a single specific point of the central office. This does not allow the battery return to use the building ground as a path. Single-point grounding is also called floating point, isolated ground plane, or isolated bonding network. (See multi-point grounding.)

Site ID A unique provisioned name given to an *AnyMedia* shelf. This name is identified by the *Navis AnyMedia* EMS as the NE name.

SNR margin of ADSL line The increase in noise, relative to the current received noise power, that can occur with a BER of 10^{-7} still being met.

Software upgrade Installing newer system software.

Standby A backup circuit pack or system entity that may be activated during a equipment failure or testing.

Sustainable cell rate (SCR) The average cell transmission rate in ATM, measured in cells per second and converted internally to bits per second. Usually, SCR is a fraction of the peak cell rate.

Switch consolidation Grouping telecommunications lines (increasing density) for better efficiency, ease of maintenance, reduced cost, space, etc.

Symmetric digital subscriber line (SDSL) A physical layer technology used to transport digital bit stream over one pair of nonloaded existing copper distribution cable. SDSL provides equal transmission bit rates for both the upstream and downstream directions ranging from 144 to 2320 kbps. SDSL is based on use of the 2B1Q line coding scheme. 2B1Q-SDSL is a baseband line coding scheme that does not allow the option to share the copper loop from a baseband POTS signal.

Synchronous optical network (SONET) A United States high-speed, fiber-optic transport standard for a fiber-optic digital hierarchy (speeds range from 51.84 Mbps to 2.4 Gbps).

T

T1 A four-wire repeater system; commonly used to refer to a DS1 signal.

T1 carrier The TDM digital T1 hierarchy used in North America and Japan with 24 voice channels constituting a single 1.544-Mbps T1 trunk.

Tagged cell	A lower-priority cell, i.e., a cell whose CLP bit is set to 1. A cell may be tagged by the system (because it violates the traffic contract on its connection) or by its source.
TDR testing	A type of wideband metallic drop test in which a test head sends a narrow-width pulse over a subscriber loop and looks for any returned pulses that were reflected back from the loop.
Test operations system	Any of a number of testing systems used to perform channel and drop testing, such as the Tollgrade LoopCare (formerly MLT) system and PGTC-compatible test systems for channel testing.
Threshold crossing alert	A threshold is a value assigned by the system user to a certain desired level (e.g., errored seconds); when the level is exceeded, a threshold crossing alert is issued.
Tier 2 NMS	A generic term for a network management system that can manage multiple kinds of network elements as a connected network. Tier 3 refers to element managers and Tier 1 refers to customer service support systems.
Time domain reflectometry (TDR) testing	A type of wideband metallic drop test in which a test head sends a narrow-width pulse over a subscriber loop and looks for any returned pulses that were reflected back from the loop.
TL1 system interface (TL1SI)	Any ASCII terminal connected to a port via an EIA-232E/574 format that uses TL1 commands to turn up a system and perform maintenance, provisioning, and other system operations.
TL1SI view	A window available in the GSI by launching a TL1SI view window though the GSI of the *AnyMedia* Management Interface.
Token	A marker that indicates the station's right to transmit that can be held by a station on a token ring or bus.
Traditional DLC subsystem	That part of the *AnyMedia* Access System which supports traditional DLC services.
Transmission control protocol/Internet protocol (TCP/IP)	The combination of a network and transport protocol developed by ARPANET for internetworking IP-based networks.
TRAP	The simple network management protocol (SNMP) operation used by a network element (NE) to send an autonomous report.
Twisted pair (TP)	The basic transmission medium consisting of 22 to 26 American wire gauge (AWG) insulated copper wire. TP can be either shielded (STP) or unshielded (UTP).

U

Universal communication channel (UCC) — A DS0 communications path between a COT and an RT of a universal *AnyMedia* Access System. The UCC is used as a LAN extension to allow a remote operations system to provision and monitor the RT via a COT that is connected to the data communications network.

Universal configuration — A remote terminal (RT) connected to a central office terminal (COT) capable of providing an analog interface to a local analog or digital switching system.

Unspecified bit rate (UBR) — An ATM service category where traffic is allocated whatever bandwidth is available at any given time. UBR does not have a pre-connection negotiated bandwidth and there are no guarantees in terms of cell loss rate and delay.

Unstructured data transfer mode (UDT) — One of the two AAL1 modes of data transfer. When using it, the circuit emulation service (CES) acts as a transparent pipe for the DS1 signal, passing all its bits while trying to maintain bit sequence integrity and bit count.

Upstream direction — Transmission direction from customer to ATM data network or telephony switch.

Upstream VP — In a daisy chain, a VP that is passed through to a shelf that is closer to the ATM transport network than the shelf being addressed. “Upstream” here does not refer to the direction of transmission. Upstream VPs are not provisioned in an AFM, but are recorded in it to help prevent errors in provisioning daisy chains.

User security classes — Refers to different user groups, each assigned with certain system access privileges. See Privileged User, General User, and Reports-only User definitions.

User-to-network interface (UNI) — The point at which the user accesses the network.

V

Variable bit rate (VBR) — A service category that supports variable bit rate data traffic with average and peak traffic parameters.

Virtual channel (VC) — A virtual link defined at an ATM interface. The lower of the two levels of cell multiplexing defined for ATM.

Virtual channel connection (VCC) — The sum of all the unidirectional virtual channel links traveled by an ATM payload from its originating point to its user destination.

Virtual circuit (VC) — A voice communications link that appears to the user to be a dedicated point-to-point circuit.

Virtual connection — A connection between end-users in which data may be passed over various circuit configurations during a single period of communication. Virtual circuits are generally set up on a per-call basis and are disconnected when the call is terminated.

VF cables — Refers generically to the tip/ring pair cables that attach to the faceplates of all APs, including the telephony and ATM xDSL APs.

VF growth — Increased demand for voice frequency capacity.

Virtual DS1 feeder — Refers to a DS1 feeder link provided by ATM circuit emulation. The term “virtual” is used to emphasize that a physical feeder (i.e., a feeder provided when the IODS1 circuit pack is used) is not being used. A virtual DS1 feeder connection is represented by the fpt AID as opposed to the ds1 AID used for the IODS1 physical feeder.

Virtual channel identifier (VCI) — A sixteen-bit field in the ATM cell header that uniquely identifies the virtual channel link with which the cell is associated. This identifier is of local significance only. It provides the lower of two levels of multiplexing.

Virtual path identifier (VPI) — In ATM, a field within the cell header that is used to switch virtual paths, defined as groups of virtual channels (VCs).

Voice frequency data enhancement (VFDE) — The feature of the *AnyMedia FAST* shelf that enhances the GR-303 interface to improve modem performance. Also see *ClearReach* feature.

Voice over DSL (VoDSL) — An application requiring a gateway that converts the voice signal from a digital switch to ATM format for transport toward the customer premises. Special CPE is required at the customer premises to provide the voice service.

Volatile data storage — Data storage (e.g., RAM, that will lose information when power is lost).

Virtual path (VP) — A virtual link defined at an ATM interface. The higher of the two levels of multiplexing defined for ATM. Used to transport an aggregation of virtual channels (VCs) between network locations in a manner somewhat analogous to a DS3 transporting multiple DS1s.

Virtual path identifier (VPI) — An eight-bit field in the ATM cell header that uniquely identifies the virtual path link with which the cell is associated. This identifier is of local significance, across an ATM interface. It distinguishes the data of one virtual path from the data of another, thus providing the higher of two levels of multiplexing.

W

Wide area network (WAN) — A network that operates over a large region and commonly uses carrier facilities and services.

Wire center consolidation — Grouping a number of central offices into one center.

X

xDSL Refers to a variety of DSL services, such as HDSL, HDSL2, SDSL, SHDSL, and ADSL.

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